



# Astronomie & Astrophysique

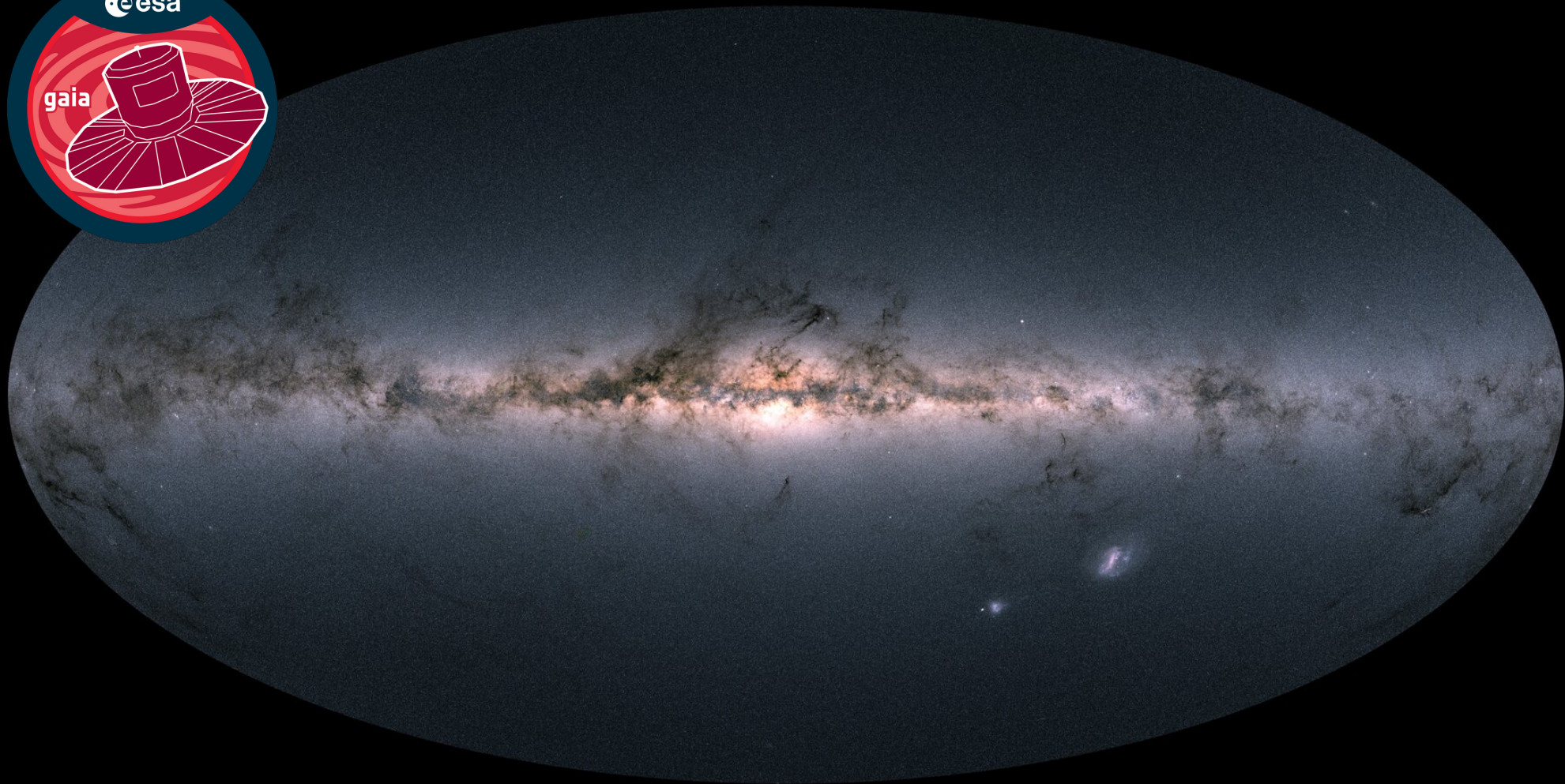


**Thibault Merle**  
Université Libre de Bruxelles  
Observatoire Royal de Belgique

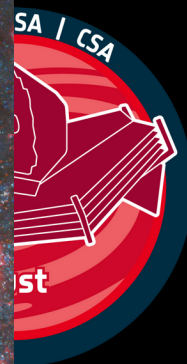
FED-**t**WIN





















# Mon parcours



- Bac S à la Réunion (2000)
- Licence de Physique Appliquée (2004)
- Master d'Astrophysique à Toulouse (2006)
- ENS de Cachan (2007)
- Doctorat à l'Observatoire de Nice (2008-2012)
- Contrats post-doctoraux à l'ULB (2012-2022)
- Contrat fédéral (FedTwin) ULB/ROB



# 2 femmes scientifiques à qui je dois beaucoup...



Griet van de Steene



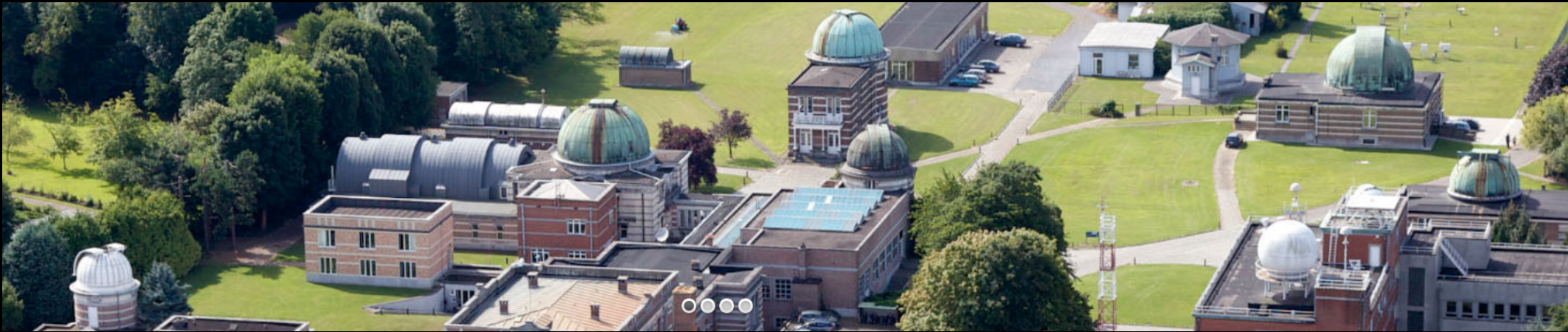
Sophie Van Eck





# Observatoire Royale de Belgique

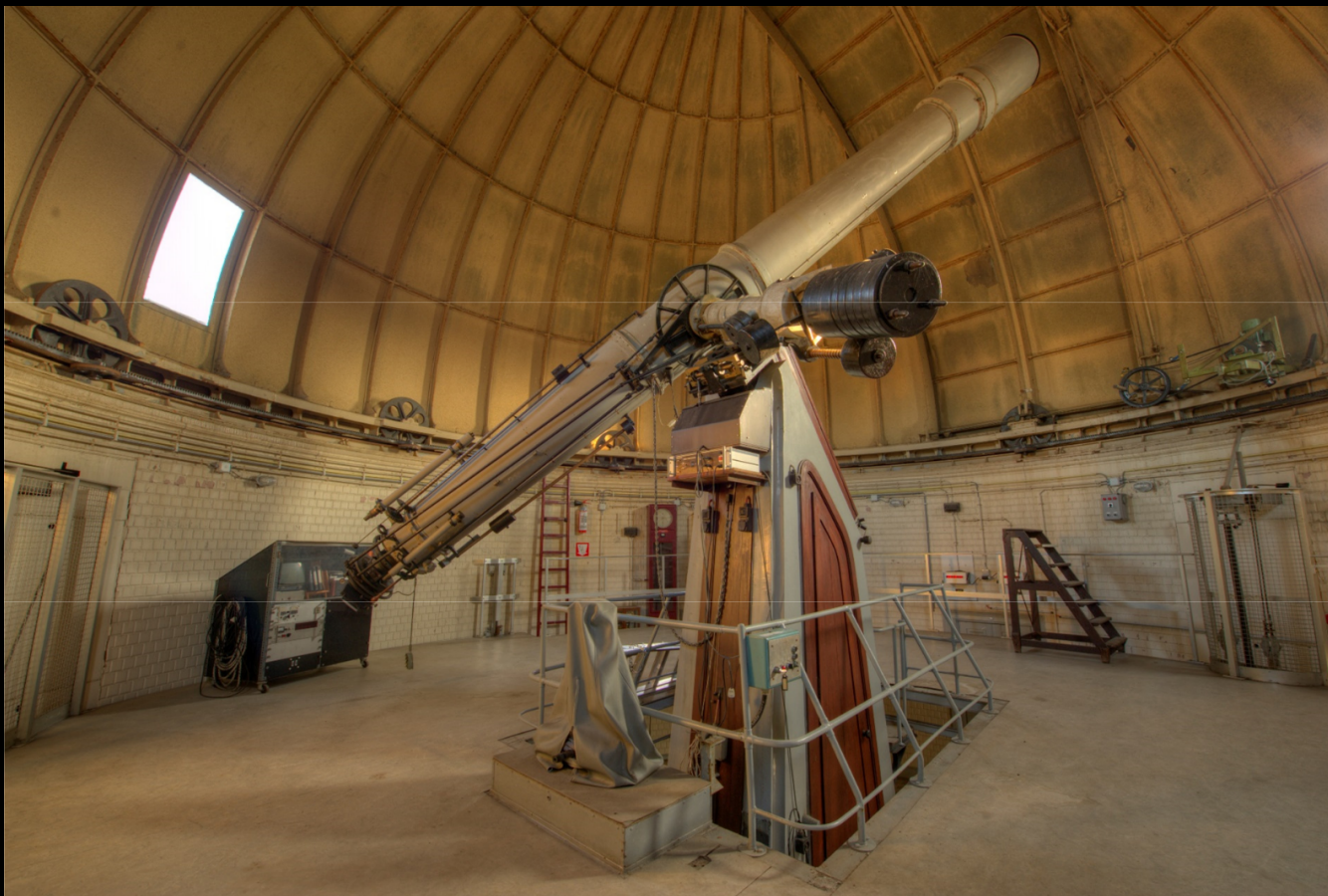
- Systèmes de référence & planétologie
- Séismologie et gravimétrie
- Physique solaire & météo spatiale
- Astronomie & astrophysique







# La grande lunette de 45 cm



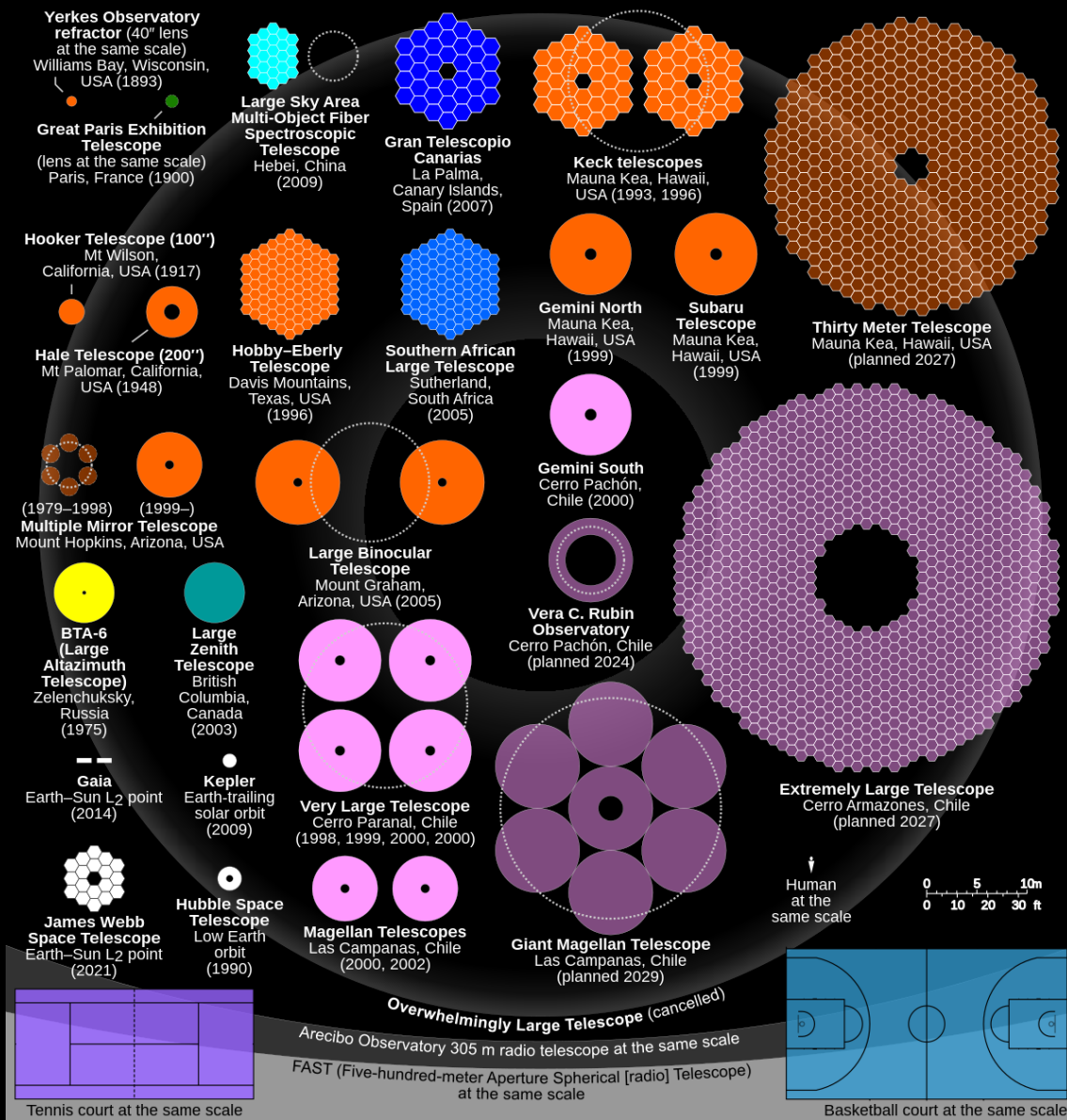
# Télescope Mercator



- La Palma (îles Canaries, Espagne)
- Observatoire Roque de los Muchachos
- Le Grantecan  
Gran Telescopio de las Canarias



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# Télescope Mercator



Liverpool & Mercator telescopes

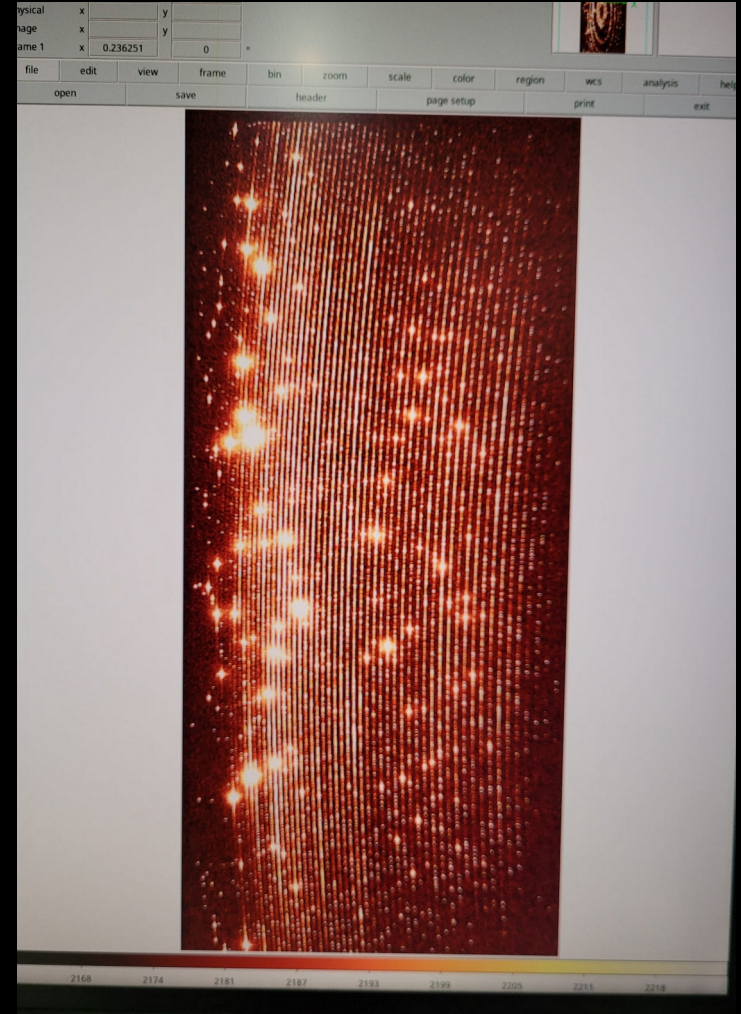
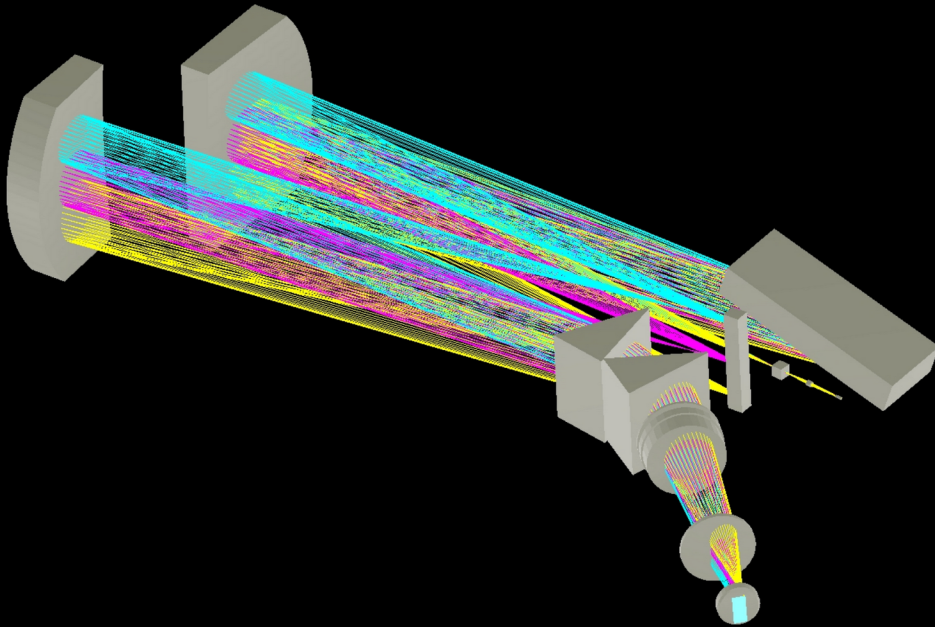


Mercator 1.2 m telescope



# Spectrographe échelle HERMES

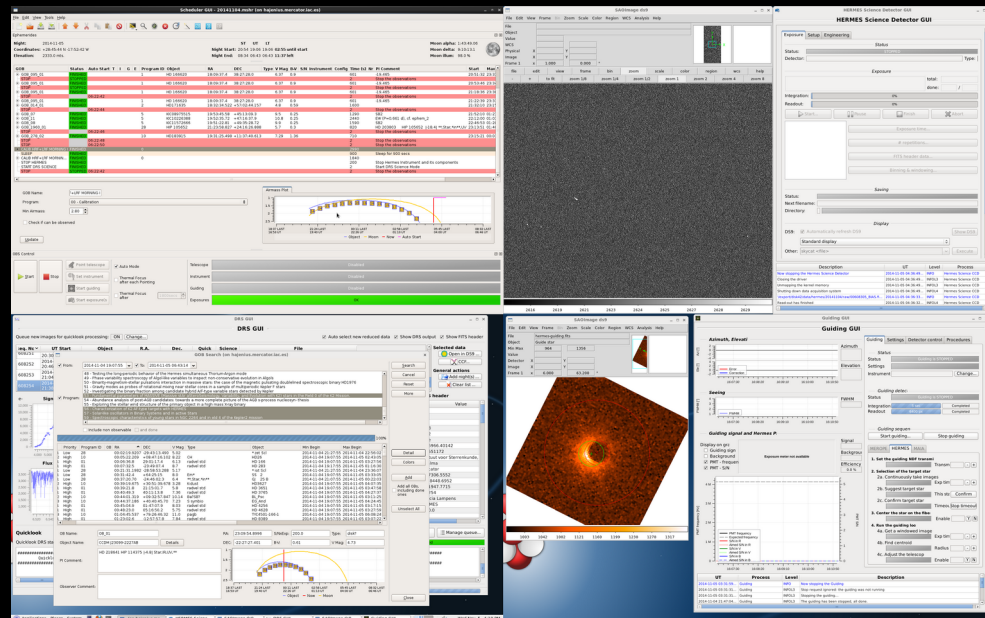
High-Efficiency and high-Resolution Mercator Echelle Spectrograph



# Télescope Mercator



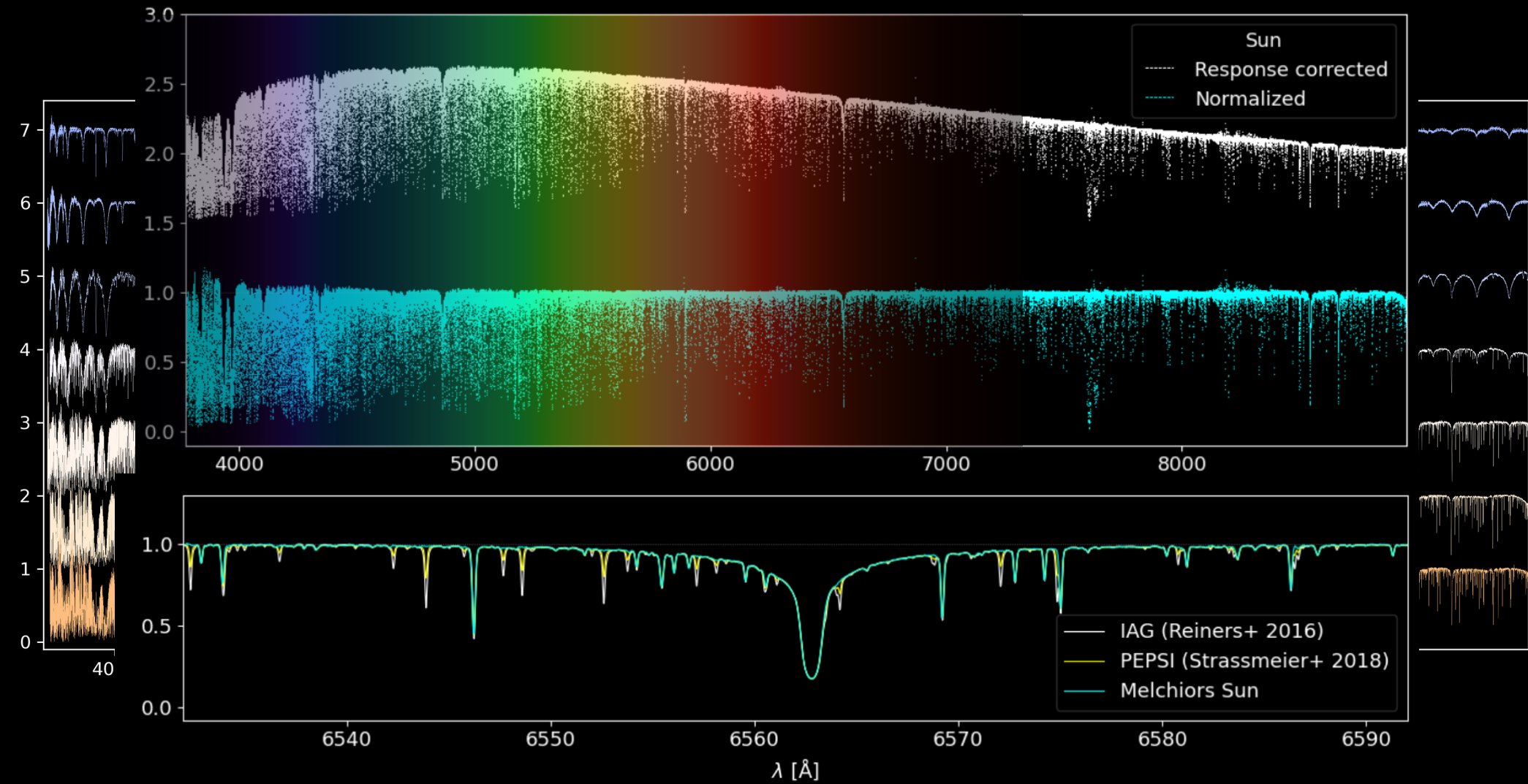
Salle de contrôle avec  
Patricia Lampens



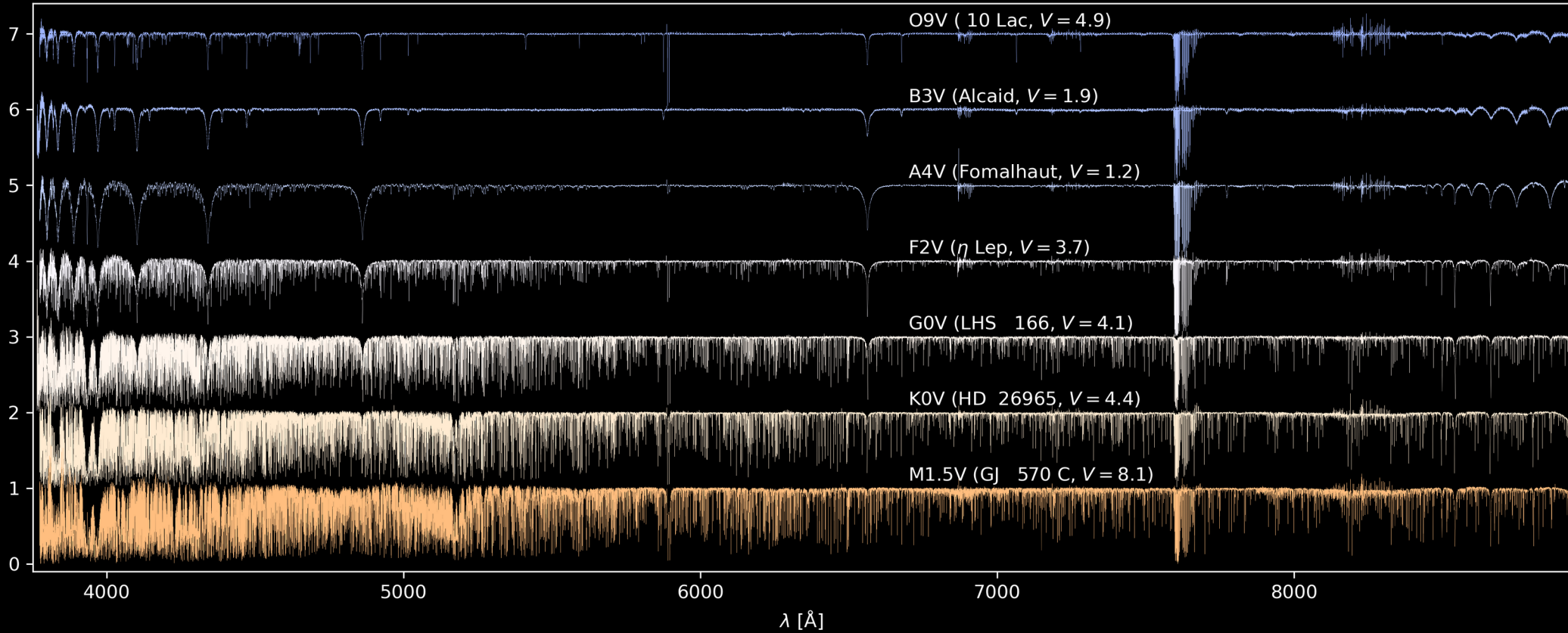
Ecrans de contrôle



# Spectres HERMES

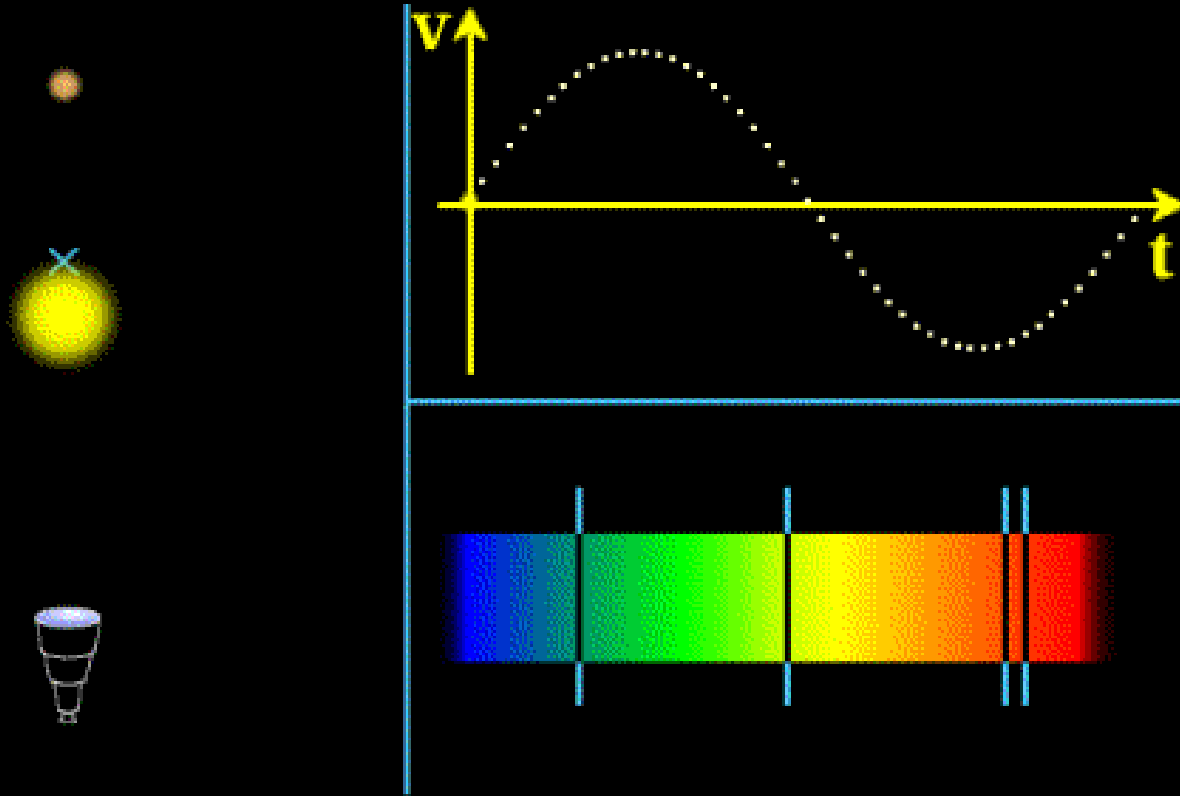


# Spectres HERMES





# Mesure de la vitesse des étoiles par effet Doppler



Vitesse radiale :  
$$v = \frac{\Delta\lambda}{\lambda_0} c$$

$\Delta\lambda$ : décalage Doppler

$\lambda_0$ : longueur au repos

$c$ : célérité de la lumière

# Merle et al. 2022, Nature Astronomy



Supernova 1994D dans la galaxie NGC 4526





# Marie Skłodowska-Curie (1867-1934)

Polonaise et française

Doctorat de la faculté des Sciences de Paris

Travaux sur la radioactivité naturelle  
Découverte du polonium et du radium

Prix Nobel de physique en 1903  
Prix Nobel de chimie en 1911

Institut du Radium de l'Institut Pasteur

# Marie Skłodowska-Curie (1867-1934)

|                                                   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                          |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                            |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                          |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                         |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                          |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                           |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                           |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| 1                                                 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 18                                                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                            |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                          |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                         |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                          |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                           |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                           |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1<br>1.0080<br>H<br>Hydrogen<br>Nonmetal          |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 2<br>4.00260<br>He<br>Helium<br>Noble Gas                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                            |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                          |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                         |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                          |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                           |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                           |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 3<br>7.0<br>Li<br>Lithium<br>Alkali Metal         |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 4<br>9.012183<br>Be<br>Beryllium<br>Alkaline Earth Metal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 5<br>10.81<br>B<br>Boron<br>Metalloid                      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 6<br>12.011<br>C<br>Carbon<br>Nonmetal                   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 7<br>14.007<br>N<br>Nitrogen<br>Nonmetal             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 8<br>15.999<br>O<br>Oxygen<br>Nonmetal                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 9<br>18.99840316<br>F<br>Fluorine<br>Haloen            |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 10<br>20.180<br>Ne<br>Neon<br>Noble Gas            |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                         |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                          |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                           |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                           |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 11<br>22.9897693<br>Na<br>Sodium<br>Alkali Metal  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 12<br>24.305<br>Mg<br>Magnesium<br>Alkaline Earth Metal  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 13<br>26.981538<br>Al<br>Aluminum<br>Post-Transition Metal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 14<br>28.086<br>Si<br>Silicon<br>Metalloid               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 15<br>30.97376...<br>P<br>Phosphorus<br>Nonmetal     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 16<br>32.07<br>S<br>Sulfur<br>Nonmetal                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 17<br>35.45<br>Cl<br>Chlorine<br>Haloen                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 18<br>39.9<br>Ar<br>Argon<br>Noble Gas             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                         |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                          |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                           |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                           |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 19<br>39.0983<br>K<br>Potassium<br>Alkali Metal   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 20<br>40.08<br>Ca<br>Calcium<br>Alkaline Earth Metal     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 21<br>44.95591<br>Sc<br>Scandium<br>Transition Metal       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 22<br>47.867<br>Ti<br>Titanium<br>Transition Metal       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 23<br>50.9415<br>V<br>Vanadium<br>Transition Metal   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 24<br>51.996<br>Cr<br>Chromium<br>Transition Metal    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 25<br>54.93804<br>Mn<br>Manganese<br>Transition Metal  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 26<br>55.84<br>Fe<br>Iron<br>Transition Metal      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 27<br>58.93319<br>Co<br>Cobalt<br>Transition Metal    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 28<br>58.693<br>Ni<br>Nickel<br>Transition Metal        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 29<br>63.55<br>Cu<br>Copper<br>Transition Metal        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 30<br>65.4<br>Zn<br>Zinc<br>Transition Metal           |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 31<br>69.723<br>Ga<br>Gallium<br>Post-Transition Metal   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 32<br>72.63<br>Ge<br>Germanium<br>Metalloid               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 33<br>74.92159<br>As<br>Arsenic<br>Metalloid              |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 34<br>78.97<br>Se<br>Selenium<br>Nonmetal                   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 35<br>79.90<br>Br<br>Bromine<br>Haloen      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 36<br>83.80<br>Kr<br>Krypton<br>Noble Gas     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 37<br>85.468<br>Rb<br>Rubidium<br>Alkali Metal    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 38<br>87.62<br>Sr<br>Strontium<br>Alkaline Earth Metal   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 39<br>88.90584<br>Y<br>Yttrium<br>Transition Metal         |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 40<br>91.22<br>Zr<br>Zirconium<br>Transition Metal       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 41<br>92.90637<br>Nb<br>Niobium<br>Transition Metal  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 42<br>95.95<br>Mo<br>Molybdenum<br>Transition Metal   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 43<br>96.90636<br>Tc<br>Technetium<br>Transition Metal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 44<br>101.1<br>Ru<br>Ruthenium<br>Transition Metal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 45<br>102.9055<br>Rh<br>Rhodium<br>Transition Metal   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 46<br>106.42<br>Pd<br>Palladium<br>Transition Metal     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 47<br>107.868<br>Ag<br>Silver<br>Transition Metal      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 48<br>112.41<br>Cd<br>Cadmium<br>Transition Metal      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 49<br>114.818<br>In<br>Indium<br>Post-Transition Metal   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 50<br>118.71<br>Sn<br>Tin<br>Post-Transition Metal        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 51<br>121.760<br>Sb<br>Antimony<br>Metalloid              |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 52<br>127.6<br>Te<br>Tellurium<br>Metalloid                 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 53<br>126.9045<br>I<br>Iodine<br>Haloen     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 54<br>131.29<br>Xe<br>Xenon<br>Noble Gas      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 55<br>132.9054...<br>Cs<br>Cesium<br>Alkali Metal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 56<br>137.33<br>Ba<br>Barium<br>Alkaline Earth Metal     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 57<br>178.49<br>La<br>Lanthanum<br>Lanthanide              |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 58<br>174.9<br>Hf<br>Hafnium<br>Transition Metal         |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 59<br>180.9479<br>Ta<br>Tantalum<br>Transition Metal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 60<br>183.84<br>W<br>Tungsten<br>Transition Metal     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 61<br>186.207<br>Re<br>Rhenium<br>Transition Metal     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 62<br>190.2<br>Os<br>Osmium<br>Transition Metal    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 63<br>192.22<br>Ir<br>Iridium<br>Transition Metal     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 64<br>195.08<br>Pt<br>Platinum<br>Transition Metal      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 65<br>196.96657<br>Au<br>Gold<br>Transition Metal      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 66<br>200.59<br>Hg<br>Mercury<br>Transition Metal      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 67<br>204.383<br>Tl<br>Thallium<br>Post-Transition Metal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 68<br>207<br>Pb<br>Lead<br>Post-Transition Metal          |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 69<br>208.98040<br>Bi<br>Bismuth<br>Post-Transition Metal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 70<br>208.98243<br>Po<br>Polonium<br>Metalloid              |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 71<br>209.98715<br>At<br>Astatine<br>Haloen |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 72<br>222.01758<br>Rn<br>Radon<br>Noble Gas   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 73<br>223.01973<br>Fr<br>Francium<br>Alkali Metal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 74<br>226.02541<br>Ra<br>Radium<br>Alkaline Earth Metal  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 75<br>267.122<br>Ac<br>Actinium<br>Actinide                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 76<br>267.122<br>Rf<br>Rutherfordium<br>Transition Metal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 77<br>268.126<br>Db<br>Dubnium<br>Transition Metal   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 78<br>269.128<br>Sg<br>Seaborgium<br>Transition Metal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 79<br>270.133<br>Bh<br>Bohrium<br>Transition Metal     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 80<br>269.136<br>Hs<br>Hassium<br>Transition Metal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 81<br>277.154<br>Mt<br>Meitnerium<br>Transition Metal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 82<br>282.166<br>Ds<br>Darmstadtium<br>Transition Metal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 83<br>282.169<br>Rg<br>Roentgenium<br>Transition Metal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 84<br>286.179<br>Cn<br>Copernicium<br>Transition Metal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 85<br>286.182<br>Nh<br>Nihonium<br>Post-Transition Metal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 86<br>290.192<br>Fl<br>Flerovium<br>Post-Transition Metal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 87<br>290.196<br>Mc<br>Moscovium<br>Post-Transition Metal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 88<br>293.205<br>Lv<br>Livermorium<br>Post-Transition Metal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 89<br>294.211<br>Ts<br>Tennessine<br>Haloen |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 90<br>295.216<br>Og<br>Oganesson<br>Noble Gas |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 91<br>138.9055<br>La<br>Lanthanum<br>Lanthanide   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 92<br>140.116<br>Ce<br>Cerium<br>Lanthanide              |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 93<br>140.90766<br>Pr<br>Praseodymium<br>Lanthanide        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 94<br>144.24<br>Nd<br>Neodymium<br>Lanthanide            |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 95<br>144.91276<br>Pm<br>Promethium<br>Lanthanide    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 96<br>150.4<br>Sm<br>Samarium<br>Lanthanide           |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 97<br>151.964<br>Eu<br>Europium<br>Lanthanide          |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 98<br>157.25<br>Gd<br>Gadolinium<br>Lanthanide     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 99<br>158.92535<br>Tb<br>Terbium<br>Lanthanide        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 100<br>162.500<br>Dy<br>Dysprosium<br>Lanthanide        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 101<br>164.93033<br>Ho<br>Holmium<br>Lanthanide        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 102<br>167.26<br>Er<br>Erbium<br>Lanthanide            |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 103<br>168.93422<br>Tm<br>Thulium<br>Lanthanide          |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 104<br>173.05<br>Yb<br>Ytterbium<br>Lanthanide            |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 105<br>174.9667<br>Lu<br>Lutetium<br>Lanthanide           |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 106<br>227.02775<br>Ac<br>Actinium<br>Actinide    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 107<br>232.038<br>Th<br>Thorium<br>Actinide              |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 108<br>231.03588<br>Pa<br>Protactinium<br>Actinide         |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 109<br>238.0289<br>U<br>Uranium<br>Actinide              |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 110<br>237.048172<br>Np<br>Neptunium<br>Actinide     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 111<br>244.06420<br>Pu<br>Plutonium<br>Actinide       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 112<br>243.061380<br>Am<br>Americium<br>Actinide       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 113<br>247.07035<br>Cm<br>Curium<br>Actinide       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 114<br>247.07031<br>Bk<br>Berkelium<br>Actinide       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 115<br>251.07959<br>Cf<br>Californium<br>Actinide       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 116<br>252.0830<br>Es<br>Einsteinium<br>Actinide       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 117<br>257.093...<br>Fm<br>Fermium<br>Actinide         |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 118<br>258.09...<br>Md<br>Mendelevium<br>Actinide        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 119<br>259.101...<br>No<br>Nobelium<br>Actinide           |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 120<br>266.120<br>Lr<br>Lawrencium<br>Actinide            |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

# Marie Skłodowska-Curie (1867-1934)



1er Congrès Solvay à  
Bruxelles (1911)

Théorie du rayonnement  
et des quantas

Unités mobiles à rayons X  
pendant la 1re GM.



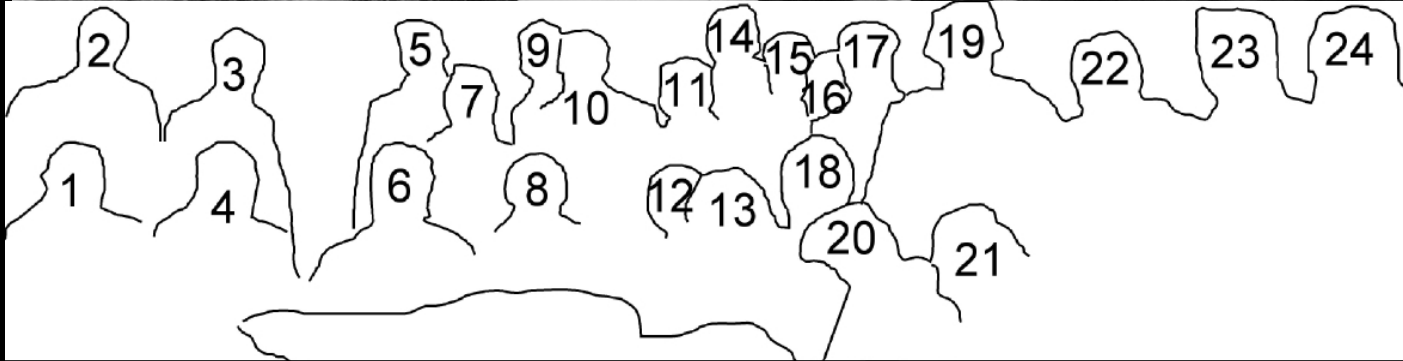
# Marie Skłodowska-Curie (1867-1934)



1er Congrès Solvay à  
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Théorie du rayonnement  
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Unités mobiles à rayons X  
pendant la 1re GM.



1 Walther Nernst. 2 Robert Goldschmidt. 3 Max Planck. 4 Marcel Brillouin. 5 Heinrich Rubens. 6 Ernest Solvay. 7 Arnold Sommerfeld. 8 Hendrik Antoon Lorentz. 9 Frederick Lindemann. 10 Maurice de Broglie. 11 Martin Knudsen. 12 Emil Warburg. 13 Jean-Baptiste Perrin. 14 Friedrich Hasenöhlrl . 15 Georges Hostelet. 16 Édouard Herzen. 17 James Hopwood Jeans. 18 Wilhelm Wien 19 Ernest Rutherford. 20 Marie Curie. 21 Henri Poincaré. 22 Heike Kamerlingh Onnes. 23 Albert Einstein 24 Paul Langevin.

# Cécilia Payne-Gaposchkin (1900-1979)



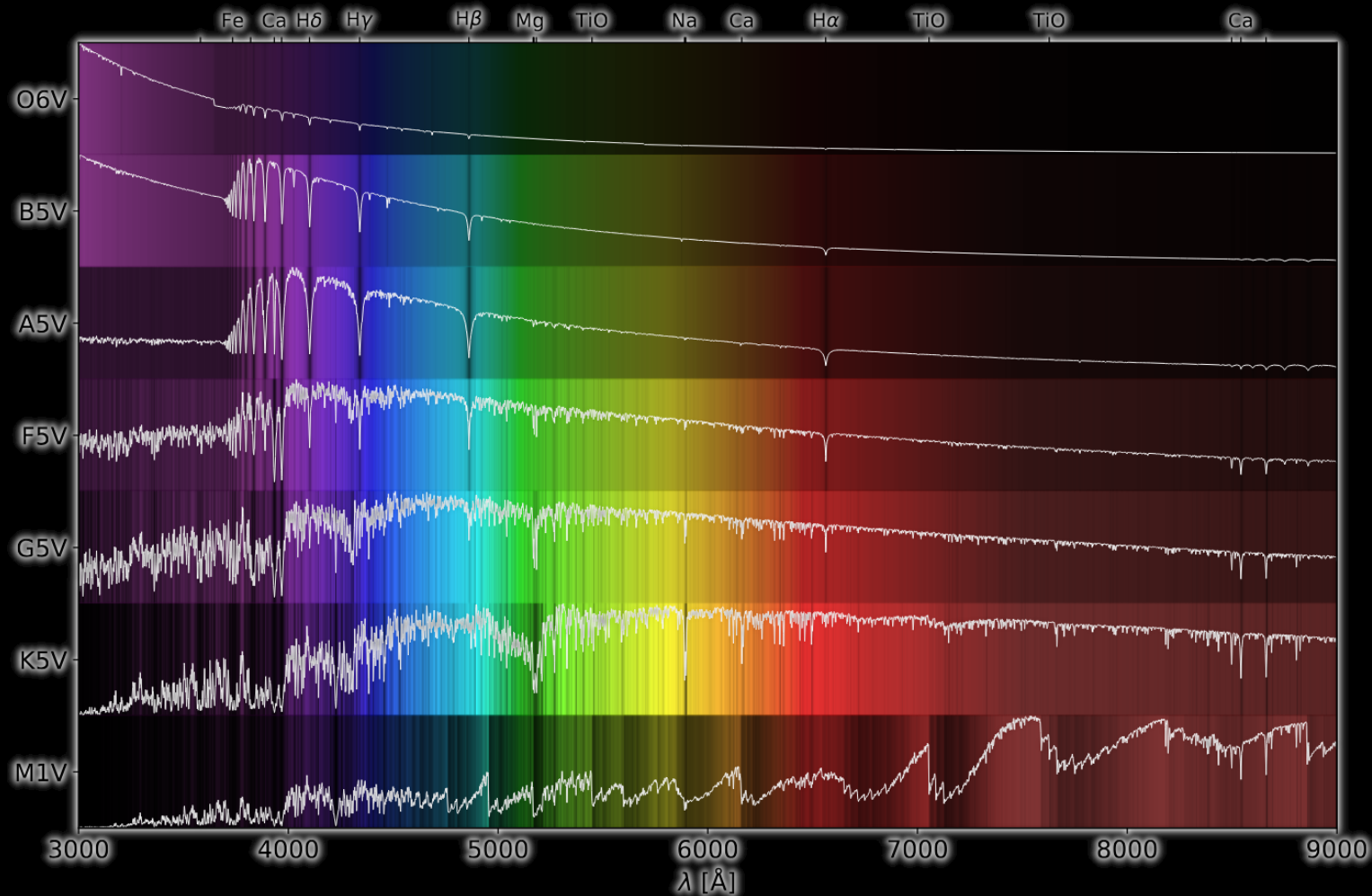
Anglaise, américaine

Doctorat au Collège Radcliff de  
Harvard

Elle montre que les étoiles sont  
essentiellement constituées d'H

Etoiles variables et novae

# Cécilia Payne-Gaposchkin (1900-1979)





# Cécilia Payne-Gaposchkin (1900-1979)



Première femme à diriger le  
département d'astronomie à  
Harvard à partir de 1956

# Margaret Burbidge (1919-2020)



Anglaise, américaine

Doctorat à l'University College  
de Londres

Nucléosynthèse stellaire

Refuse le prix d'astronomie  
Annie Cannon car réservée aux  
femmes

Présidente de la société  
américaine d'astronomie

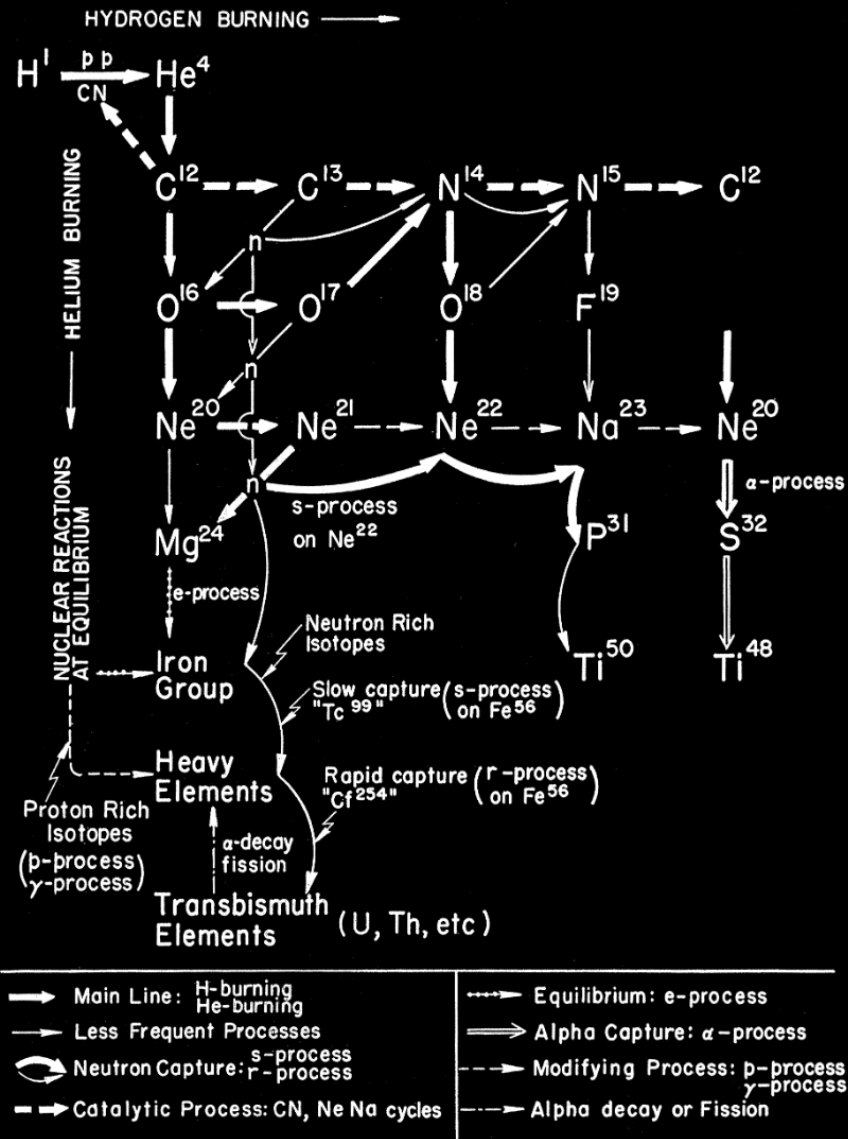
# Margaret Burbidge (1919-2020)

Article B<sup>2</sup>FH en 1957

dans *Review of Modern Physics*

- Margaret Burbidge
- Geoffrey Burbidge
- Fred Hoyle
- William Fowler

Synthèse des éléments dans les étoiles





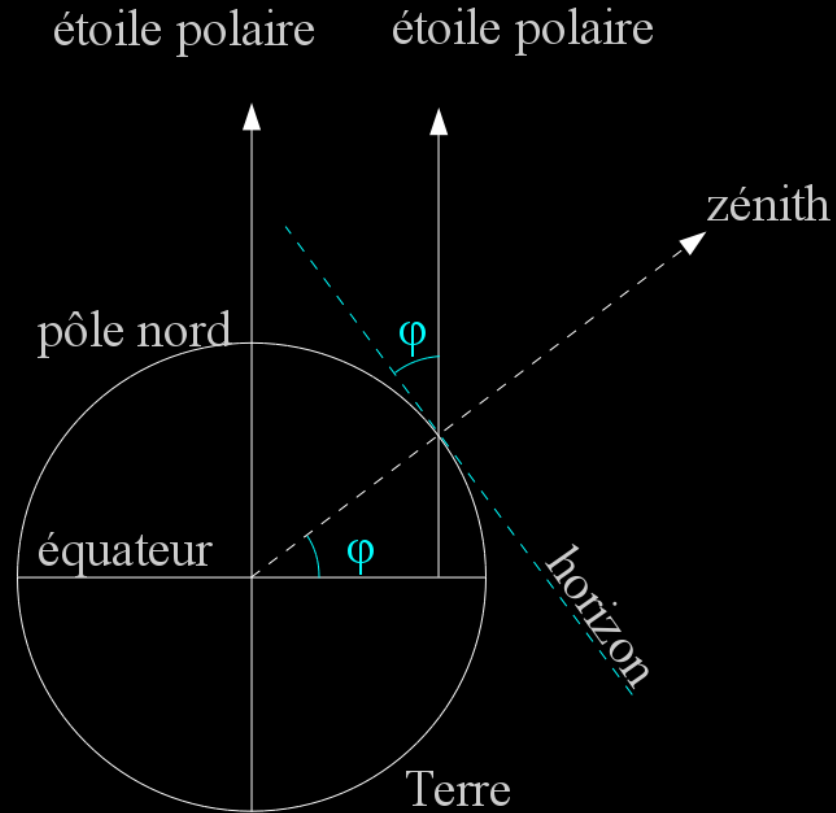
Quels arguments à opposer à un platiste ?



# 1. Navire disparaissant à l'horizon



## 2. Variation de la hauteur des étoiles



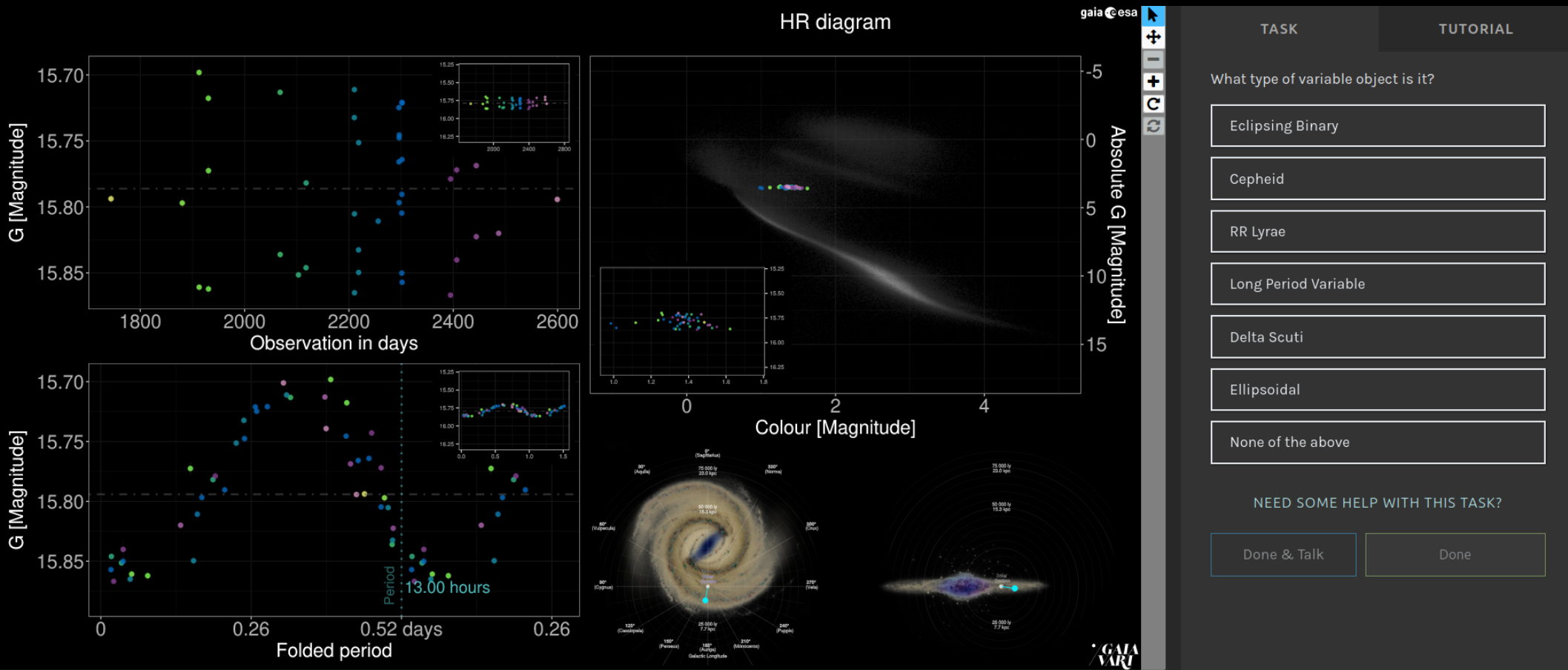


### 3. Ombre projetée lors des éclipses de Lune



# Comment découvrir si l'astronomie/l'astrophysique est pour moi?

- Clubs d'astronomes amateurs :
  - <https://www.ffaab.be>
  - <https://www.latitude5050.be>
  - <https://www.mira.be>
- Camps d'été (e.g. Euro Space Center à Transinne)
- Cours Public d'astronomie at ULB <http://www.astro.ulb.ac.be/pmwiki/IAA/CPA>
- Projets de codage gratuit en ligne (p.e. CodeAcademy)
- Science participative (e.g. <https://www.zooniverse.org/projects/gaia-zooniverse/gaia-vari/classify>)
- Expérience de travail : lettre de motivation + CV
  - Institut de recherche comme ROB
  - Laboratoire d'astrophysique dans les universités (ULB/VUB, KUL, ULiège, UMONS)





# Les métiers autour du spatial, de l'astronomie & de l'astrophysique

