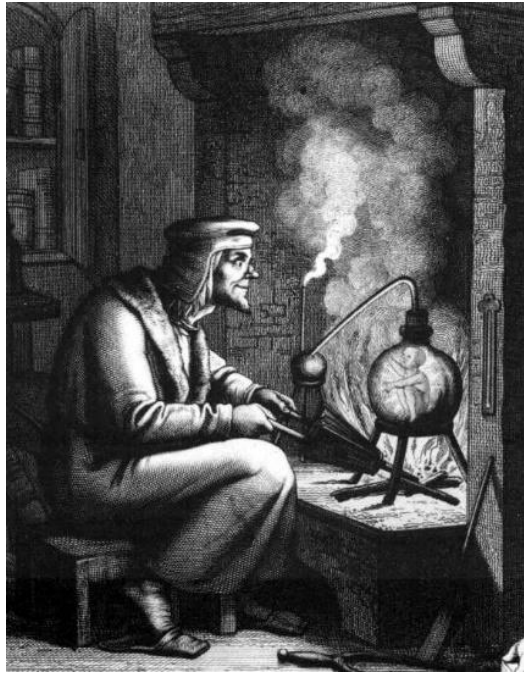
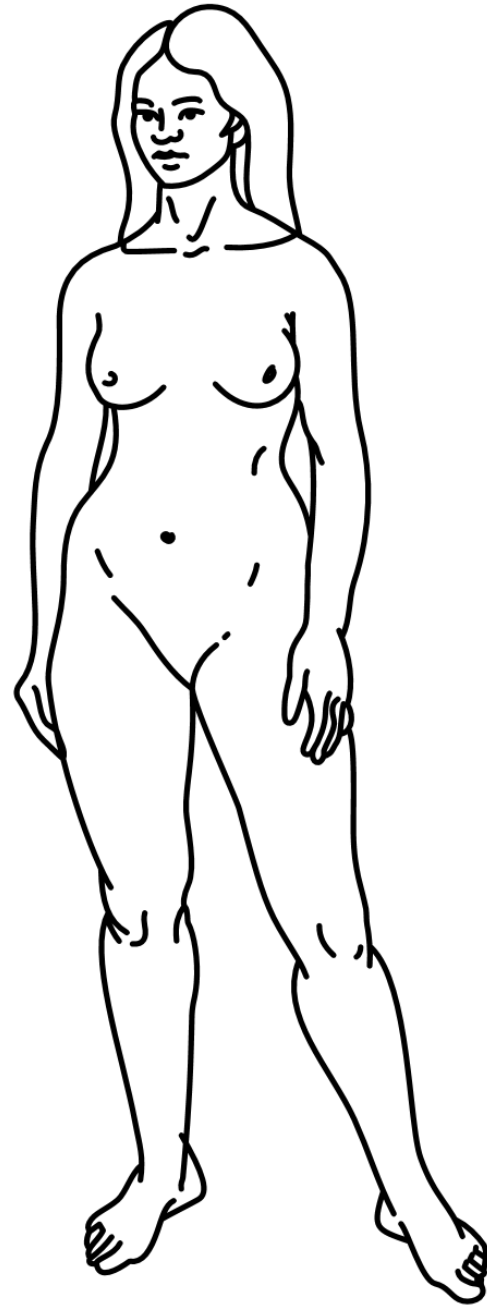
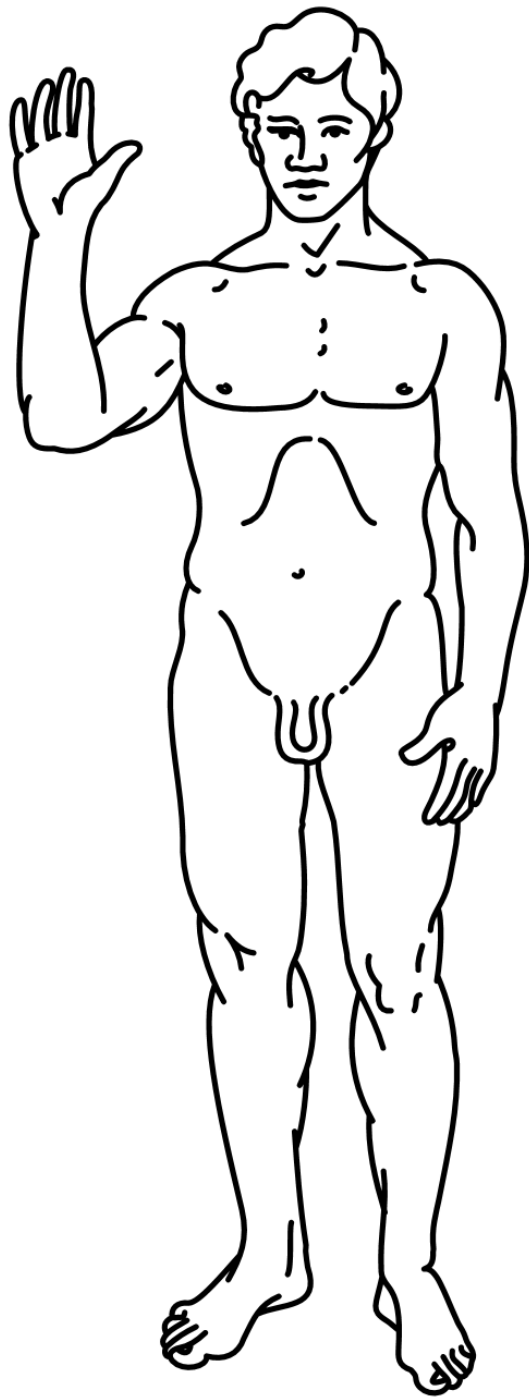


# Kosmische Hexenkessel

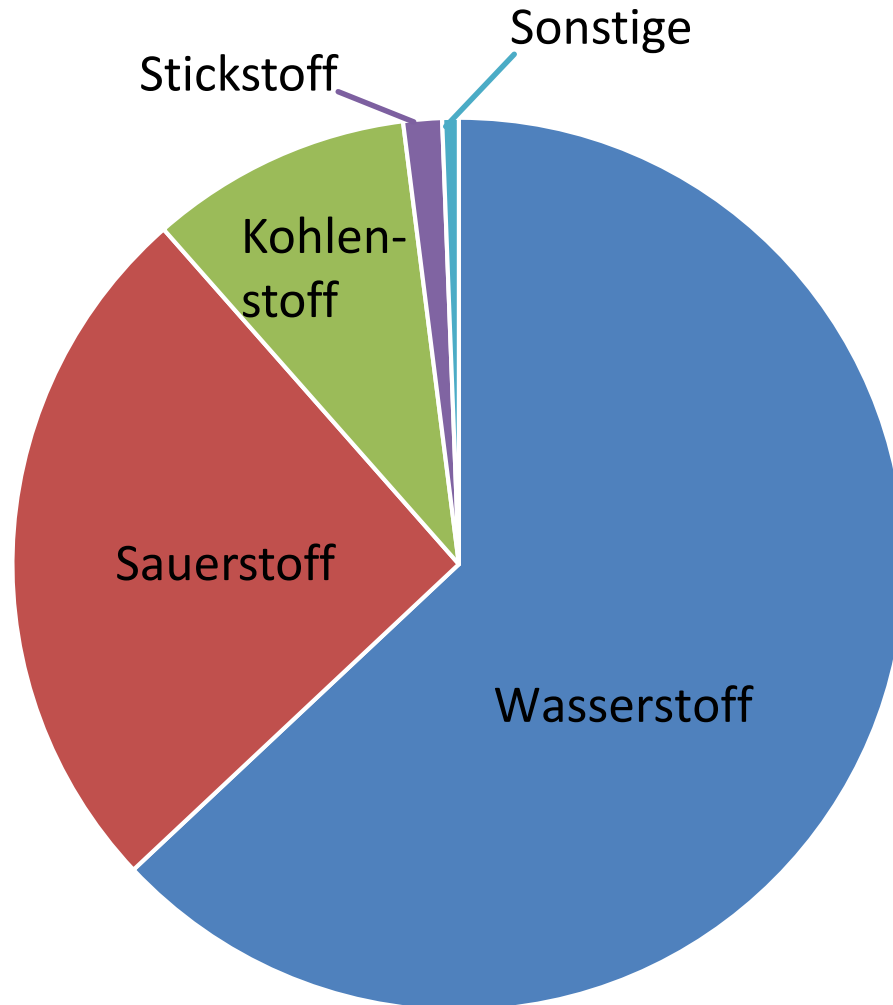
René Reifarth

Goethe-Universität Frankfurt





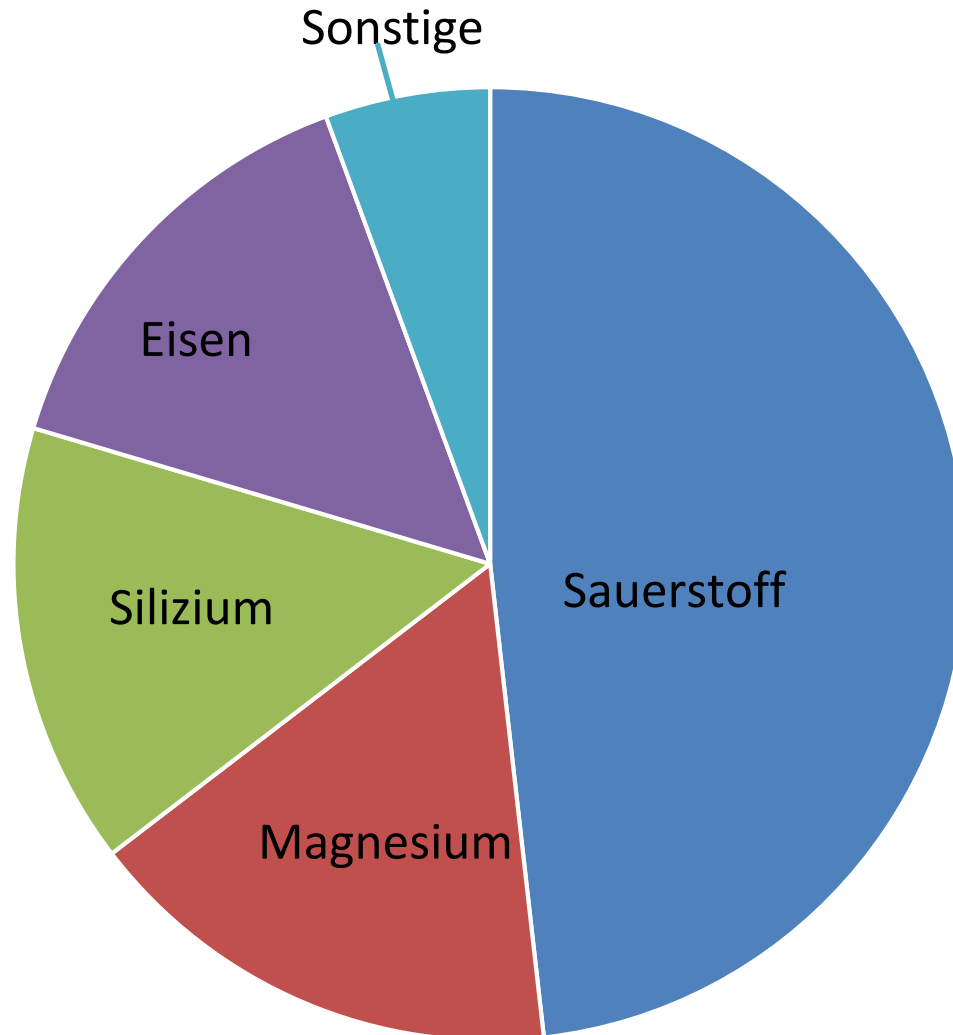
# Mensch







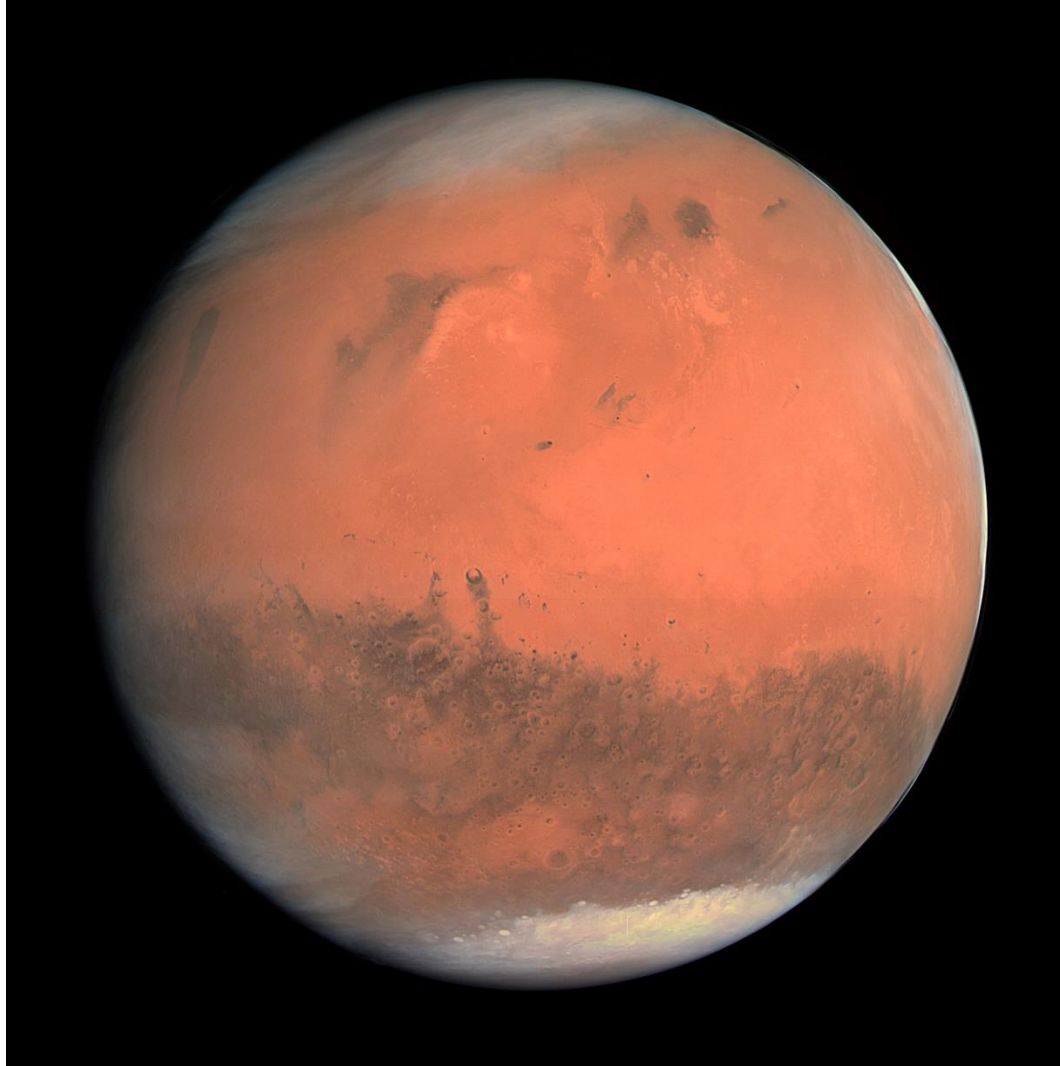
# Erde



# Erde – Sand & Rost



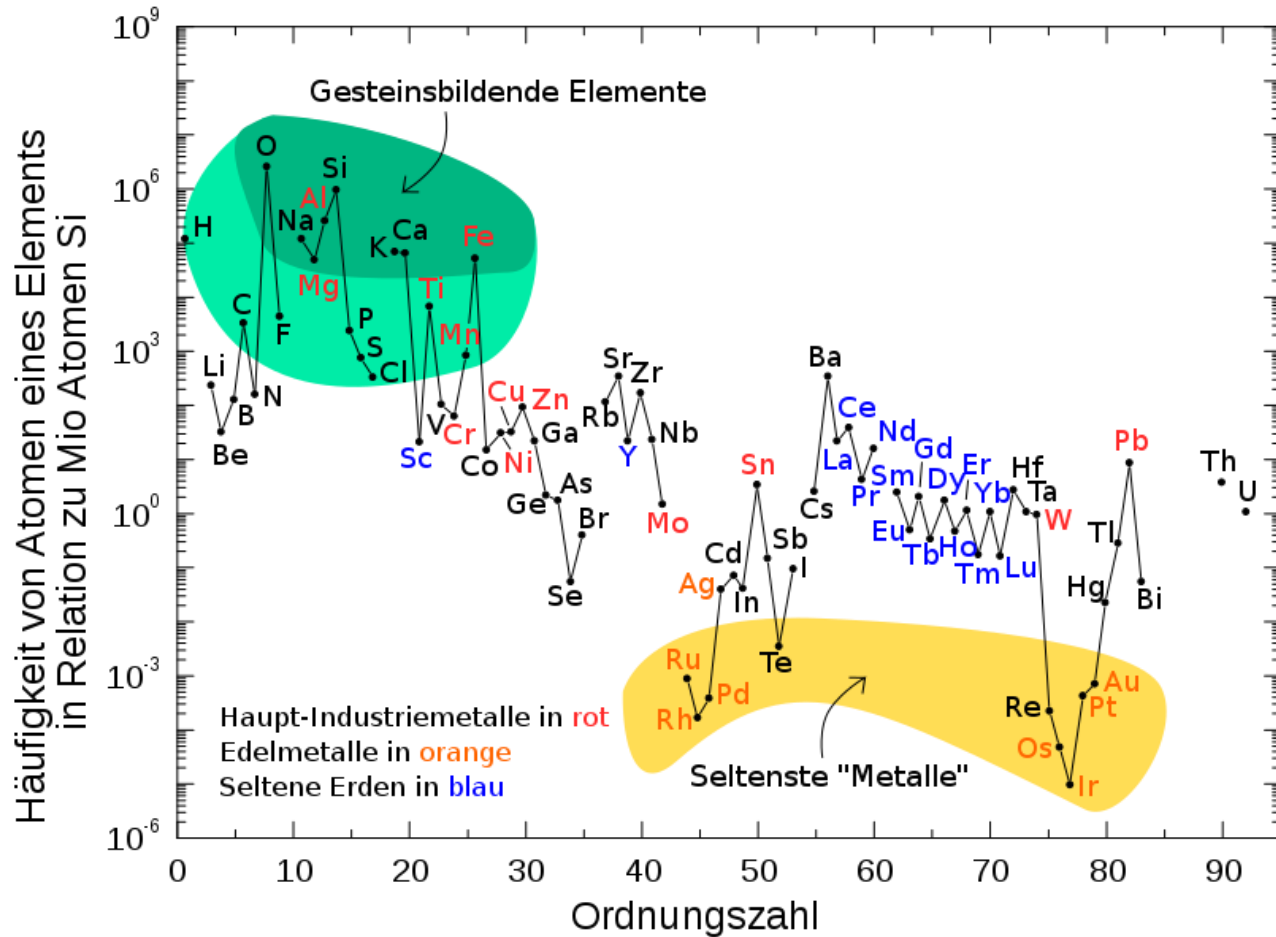
# Mars – Sand & Rost



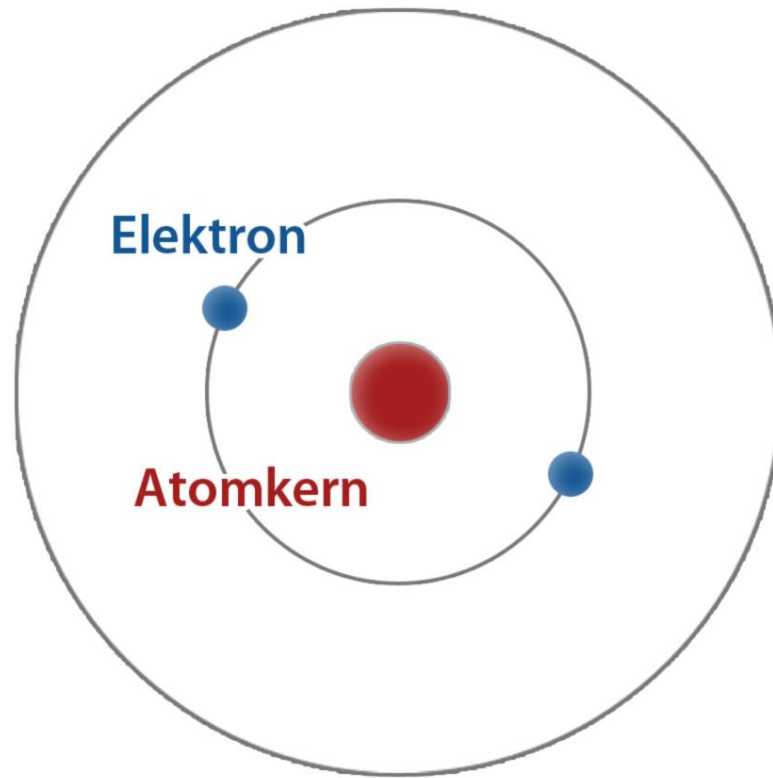
By ESA - European Space Agency & Max-Planck Institute for Solar System Research for OSIRIS Team ESA/MPS/UPD/LAM/IAA/RSSD/INTA/UPM/DASP/IDA - [http://www.esa.int/spaceinimages/Images/2007/02/True-colour\\_image\\_of\\_Mars\\_seen\\_by\\_OSIRIS](http://www.esa.int/spaceinimages/Images/2007/02/True-colour_image_of_Mars_seen_by_OSIRIS), CC BY-SA 3.0-igo, <https://commons.wikimedia.org/w/index.php?curid=56489423>



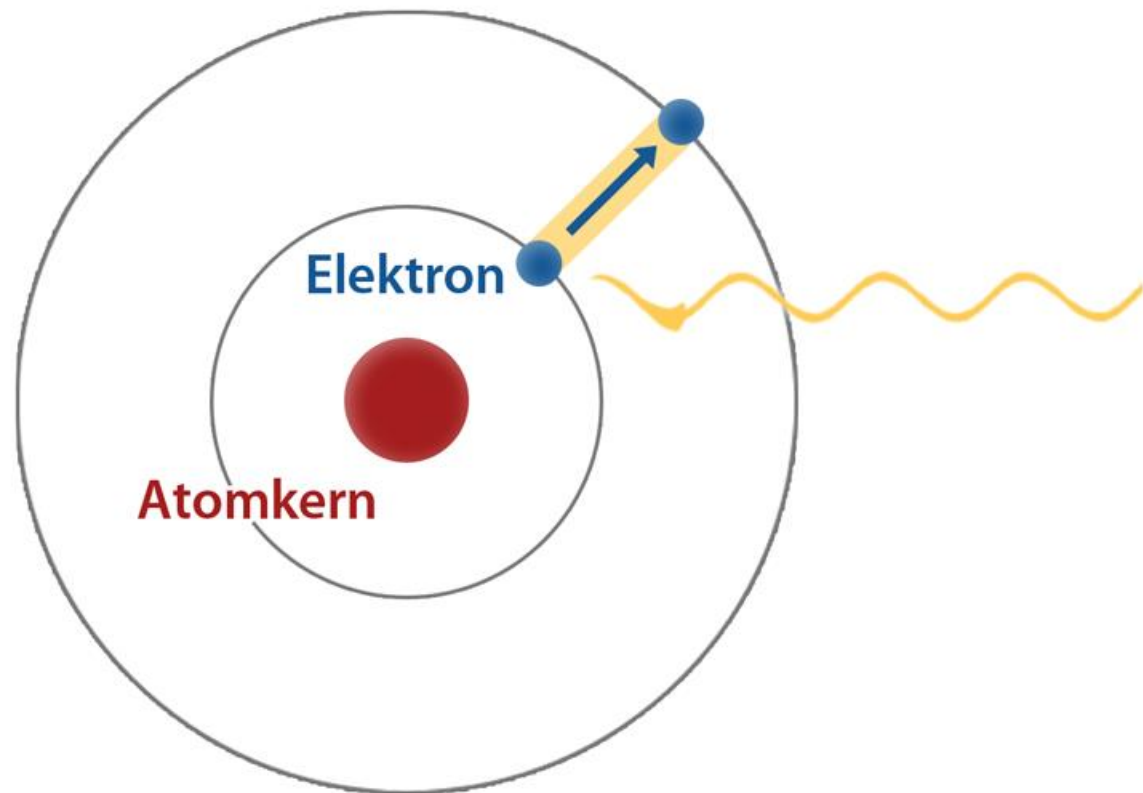
# Die Erde – en detail



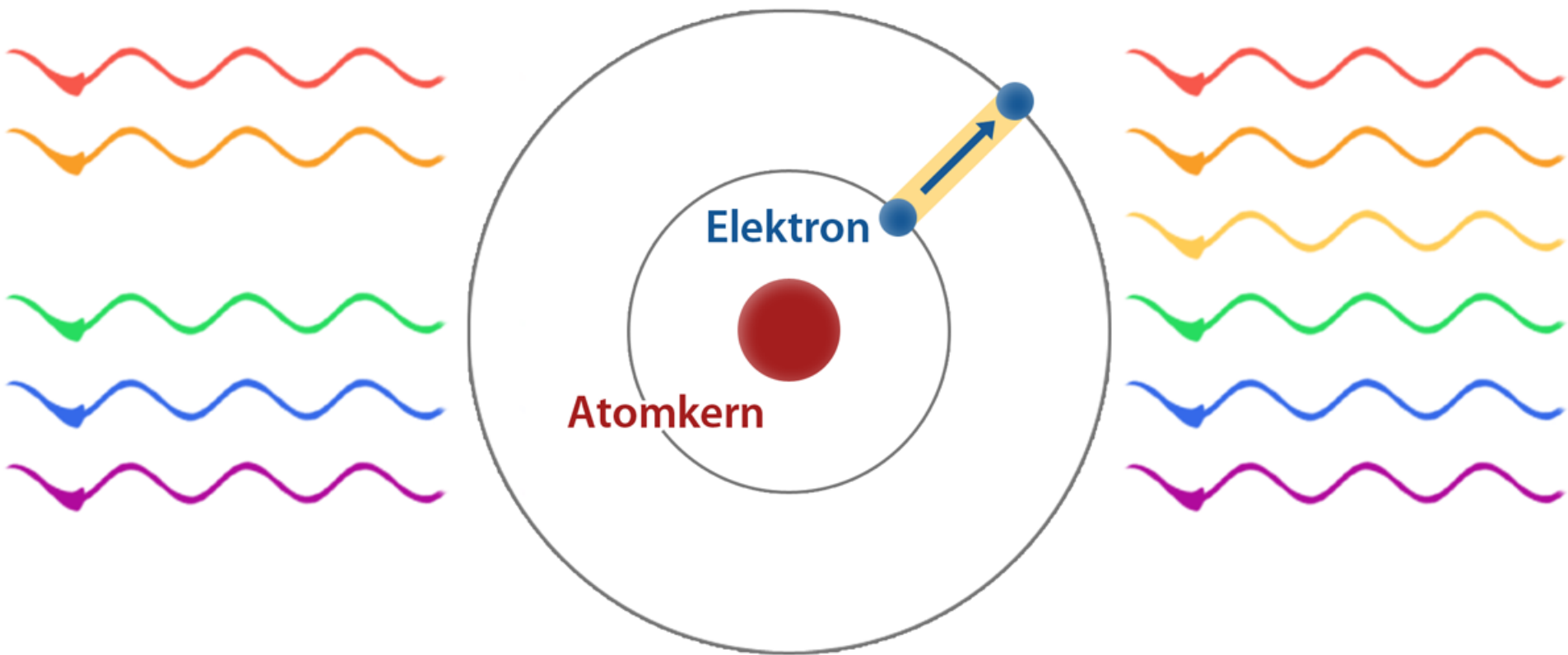
# Aufbau der Atome



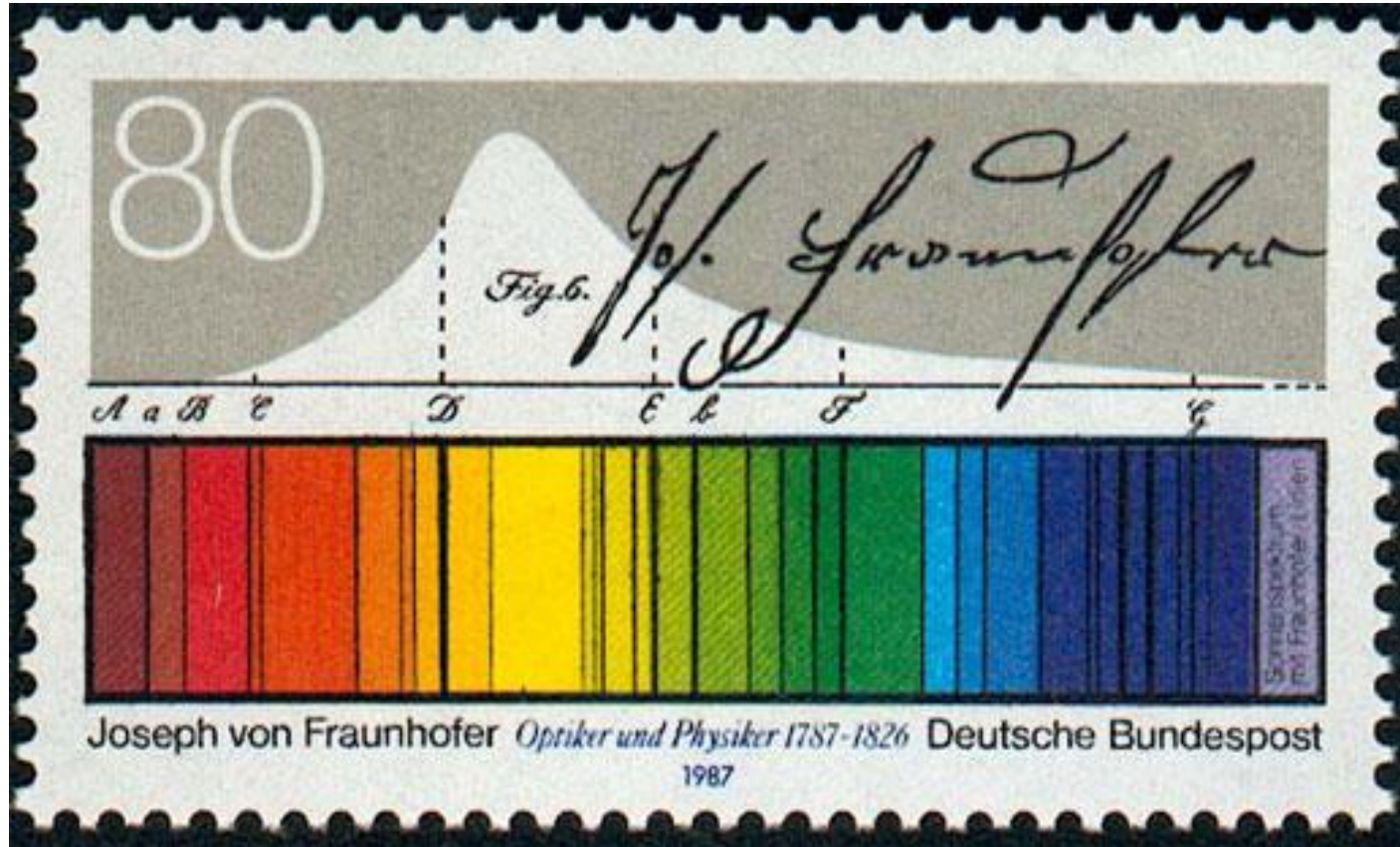
# Absorption von Photonen



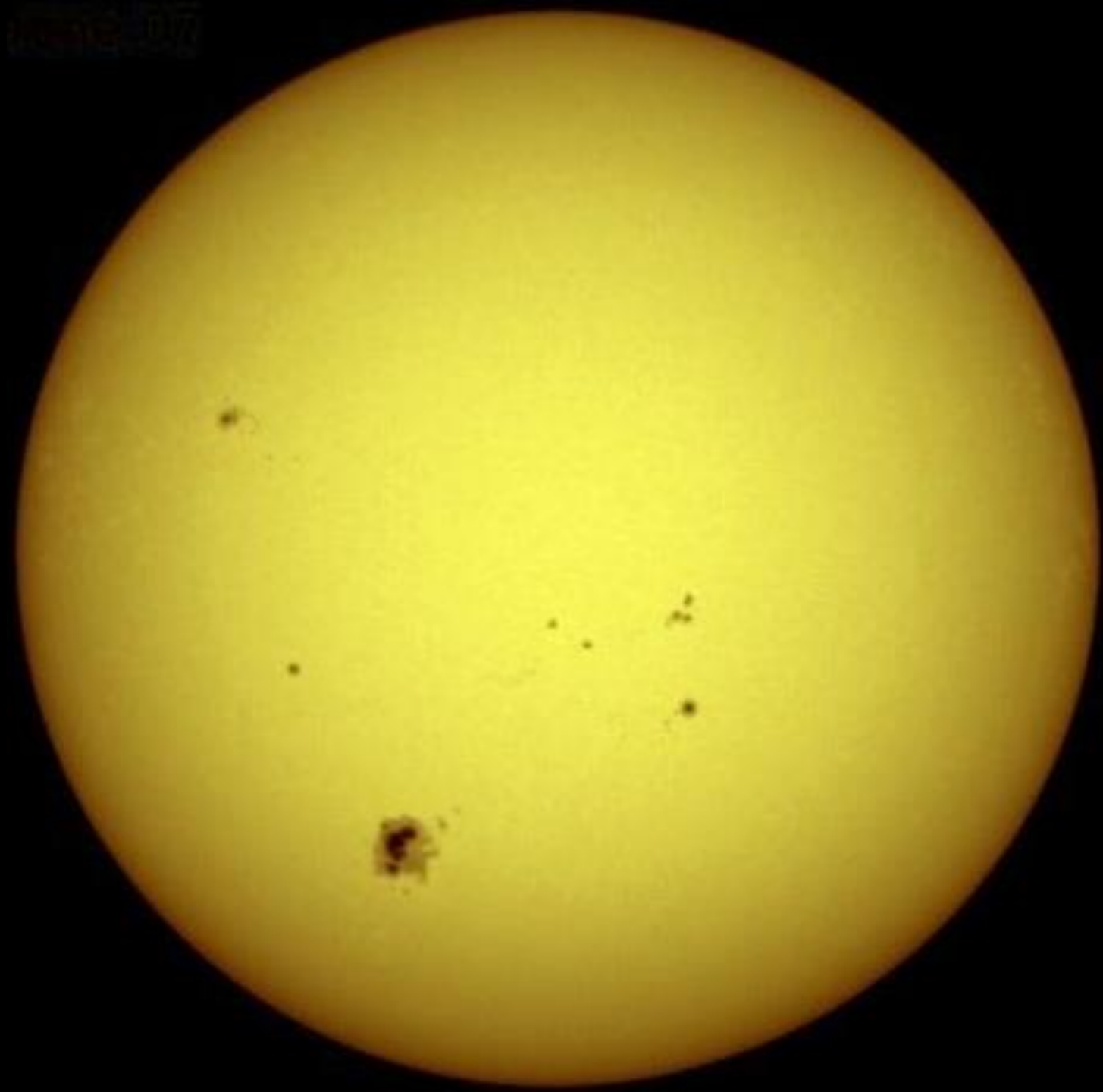
# Absorption von Photonen



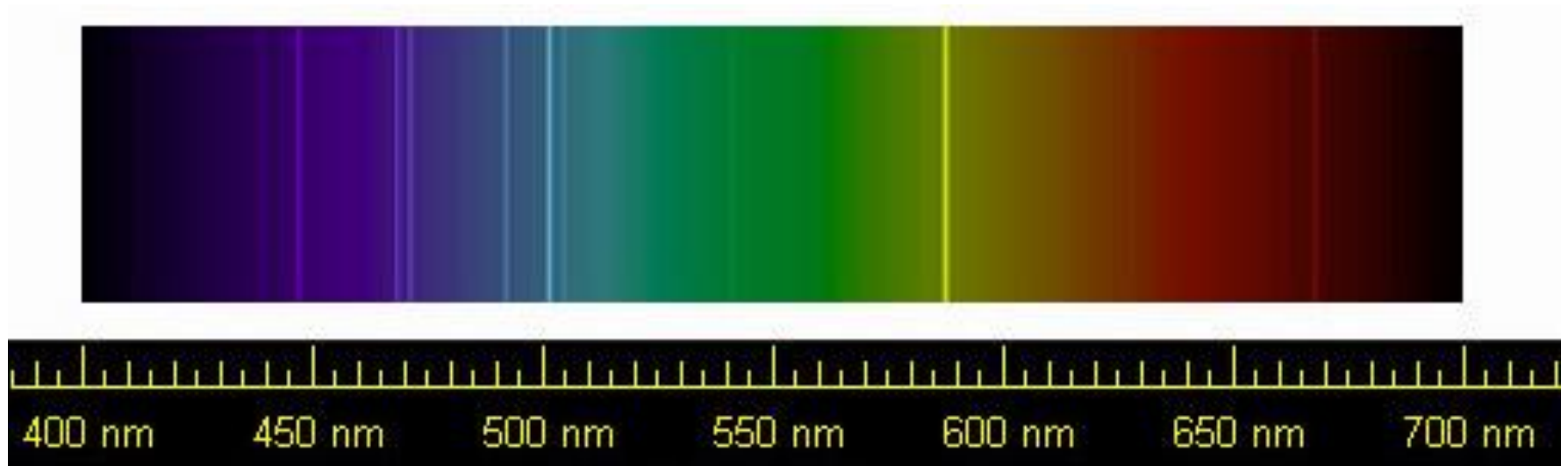
# Fraunhofer – ein Blick in die Ferne



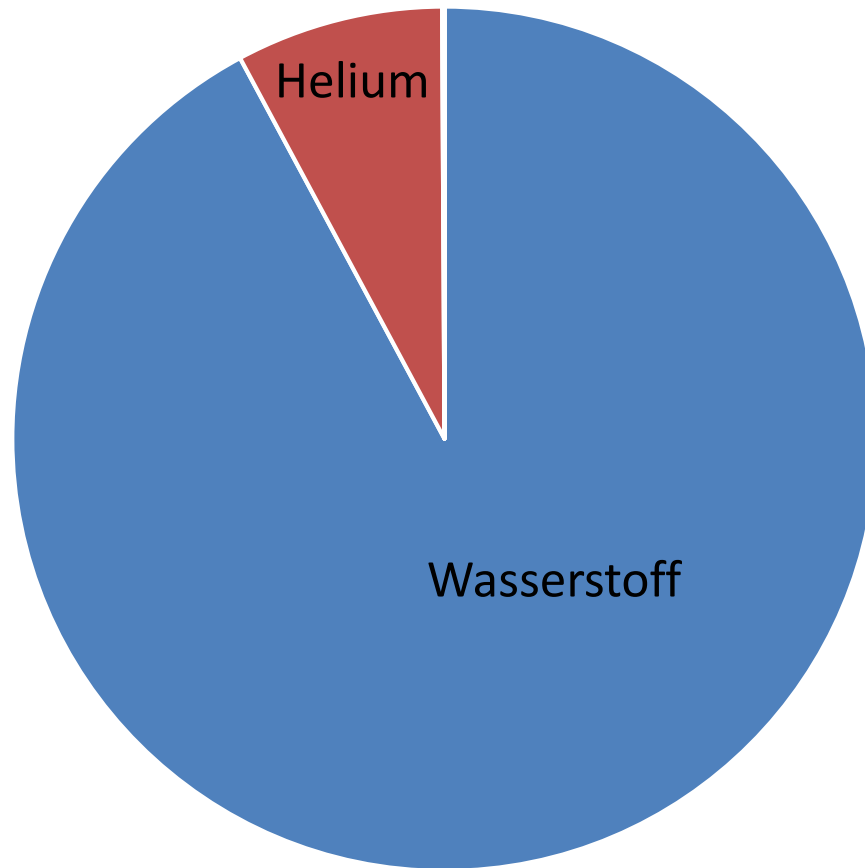




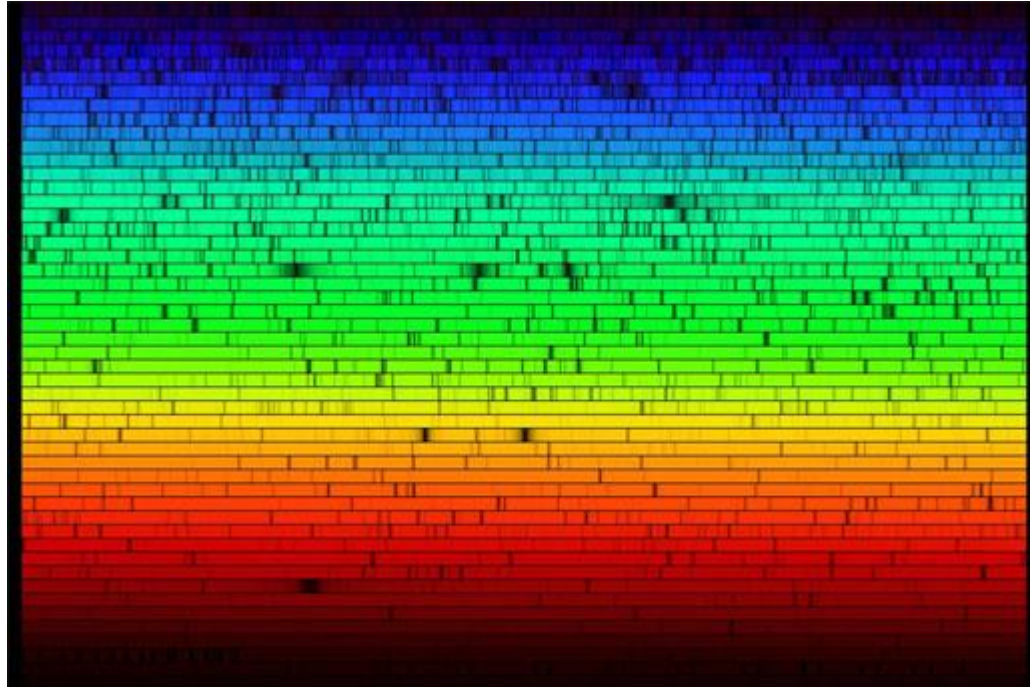
# Helium – das Sonnenelement



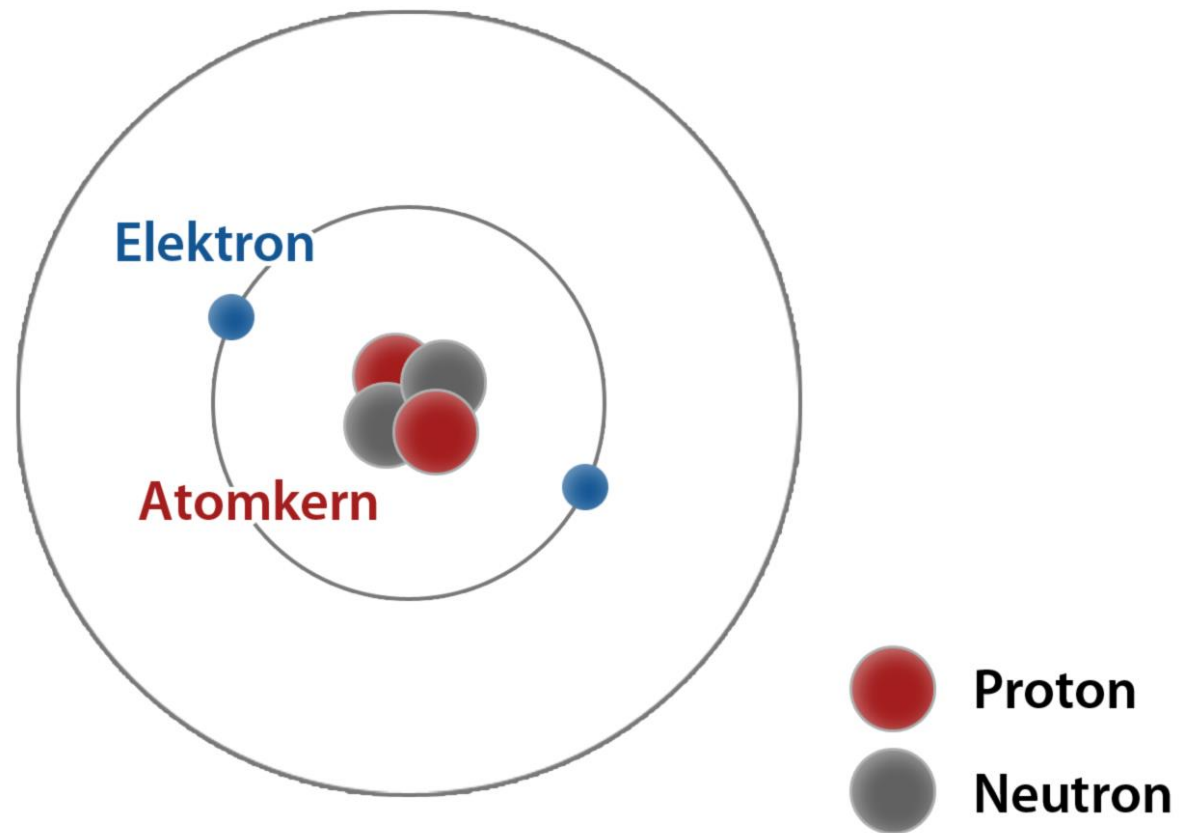
# Sonnensystem



# Genauer Blick zur Sonne

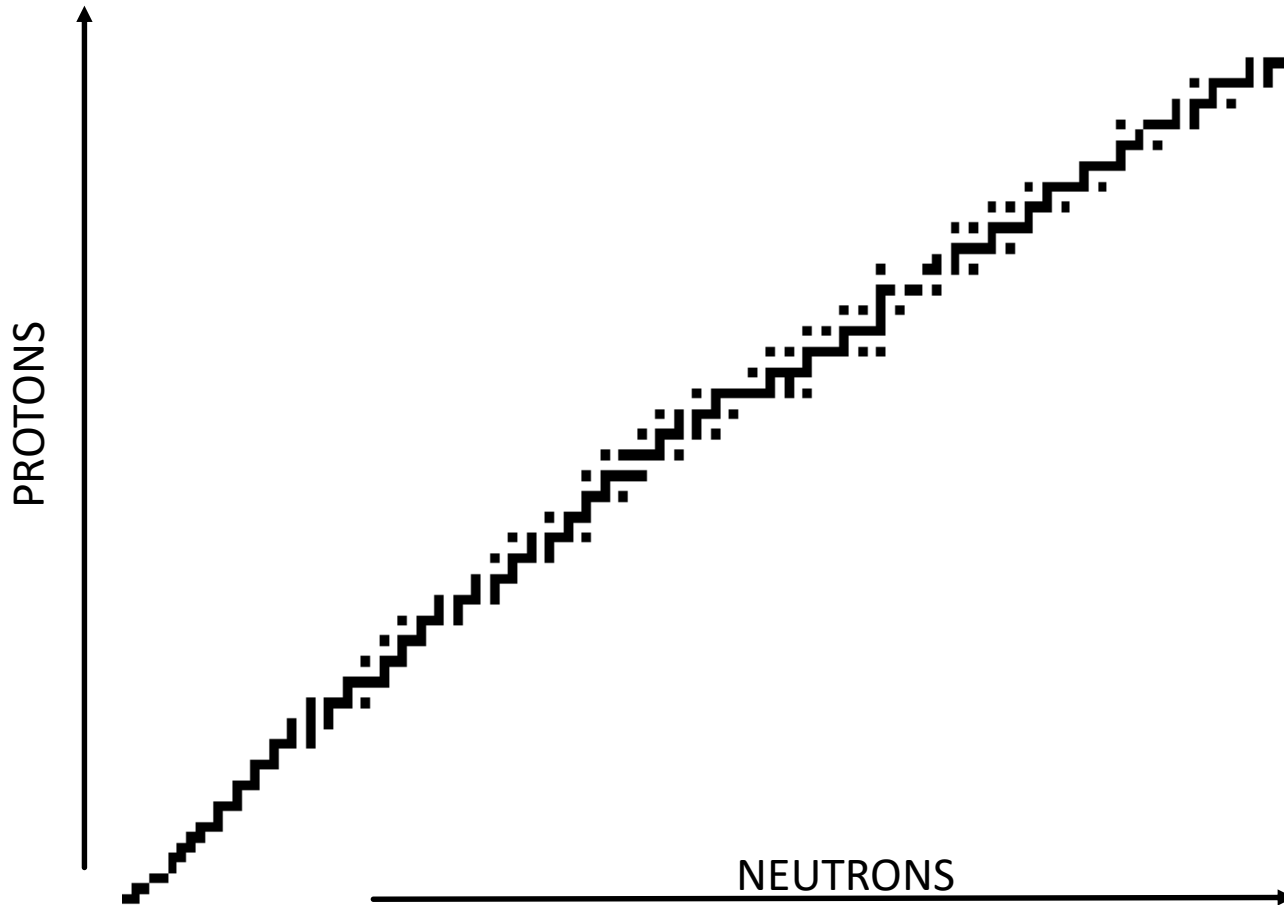


# Aufbau der Atomkerne

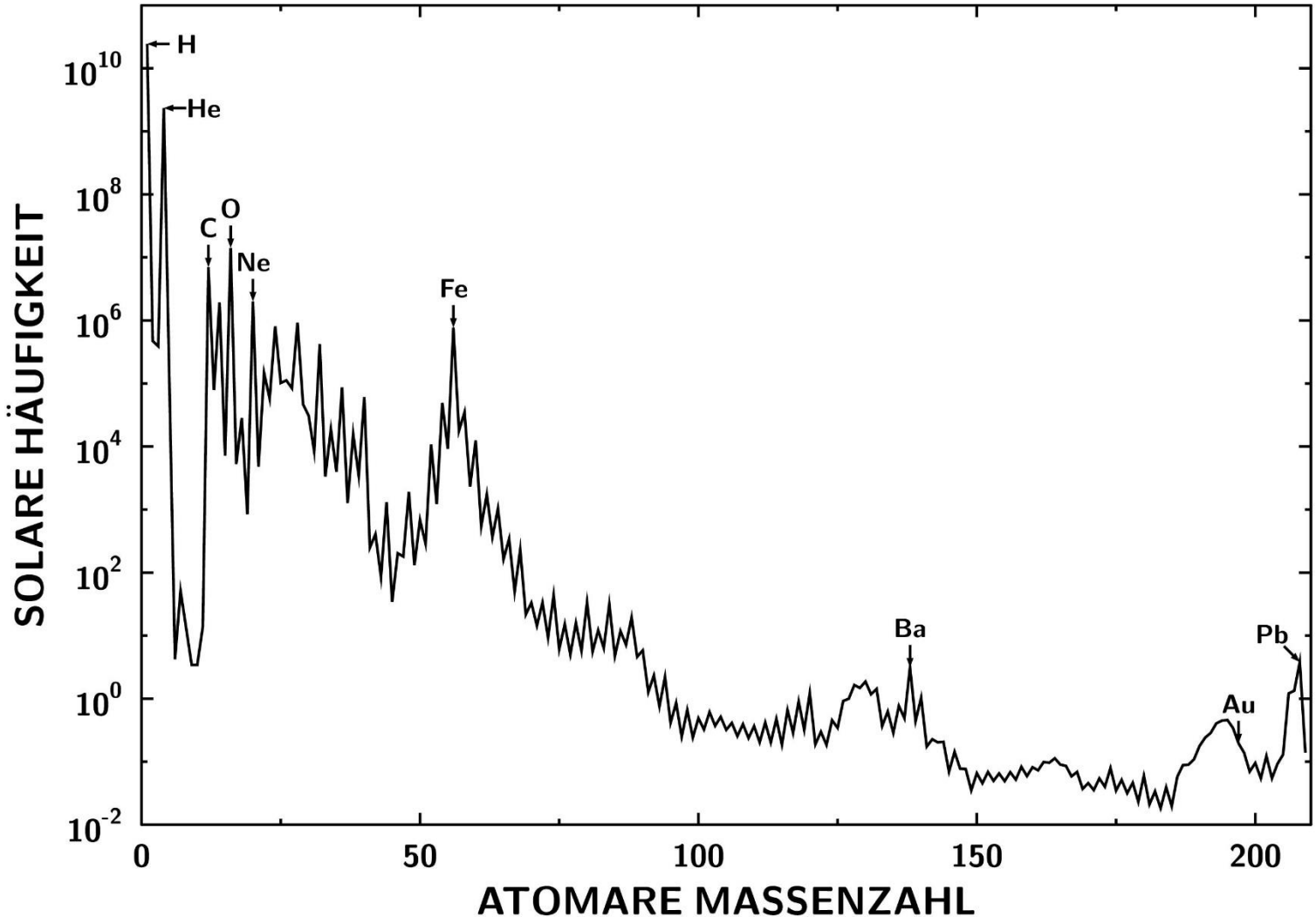




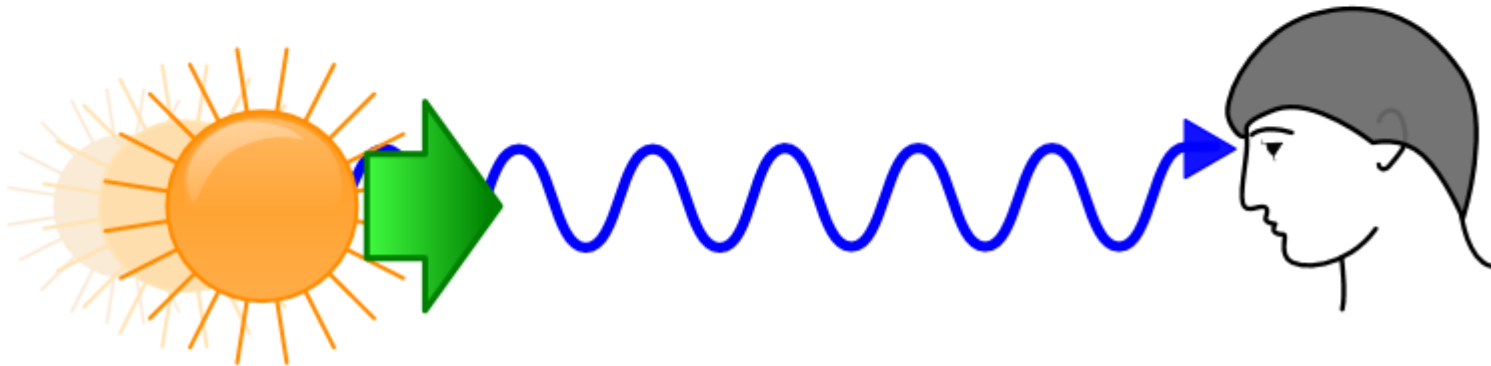
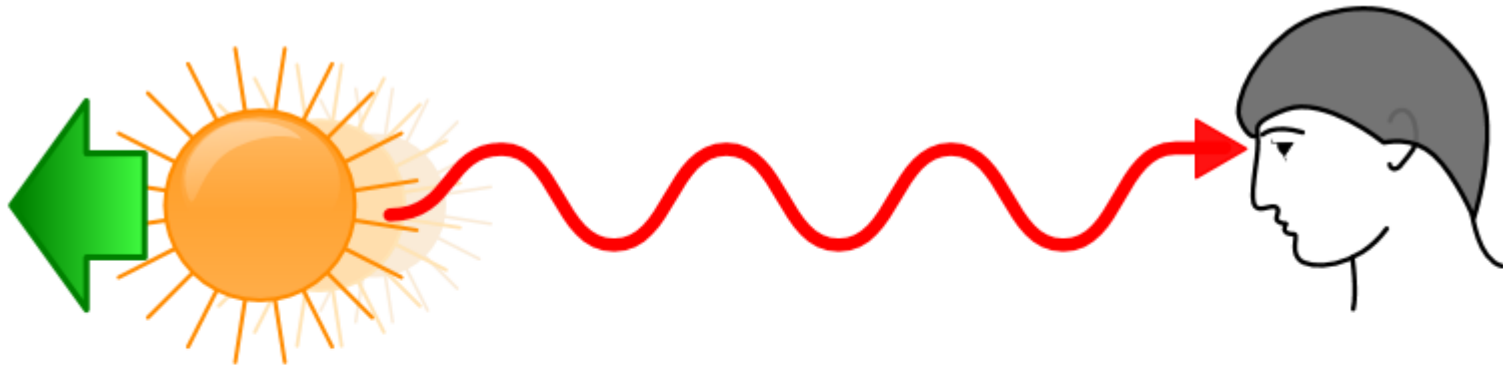
# Die Karte der stabilen Isotope



# Häufigkeitsverteilung im Sonnensystem

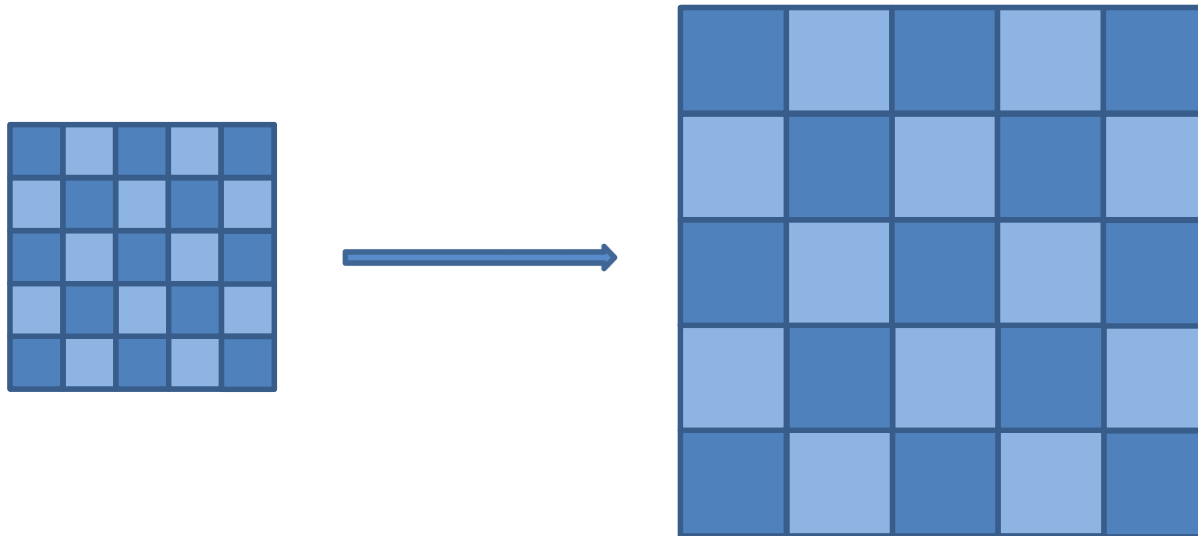


# Bewegte Objekte verändern ihre Farbe



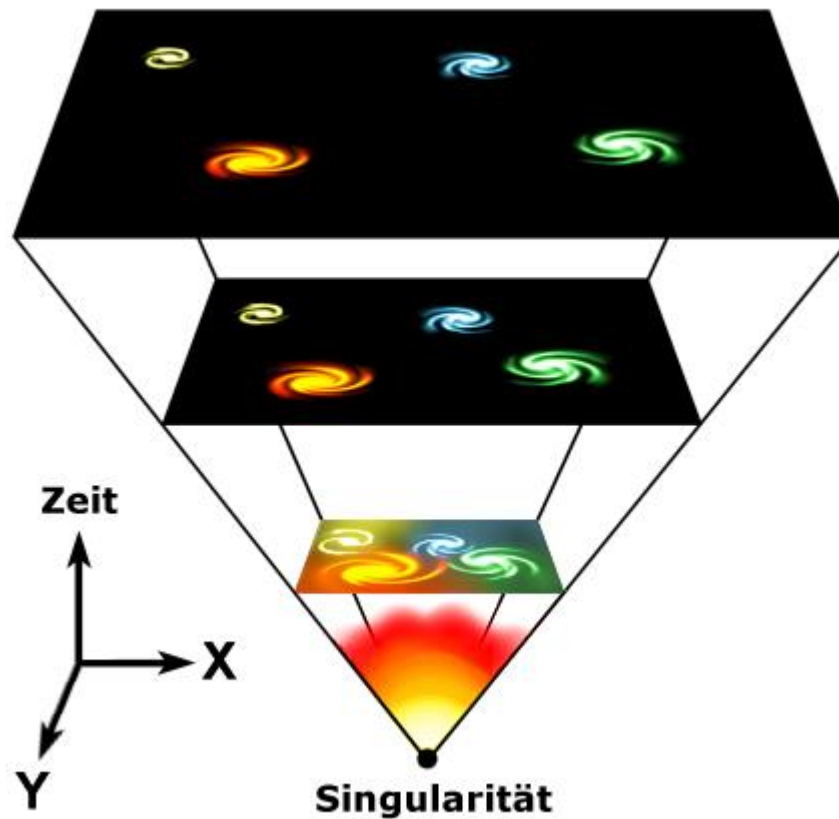
# Hubblesches Gesetz

Geschwindigkeit / Entfernung = konstant



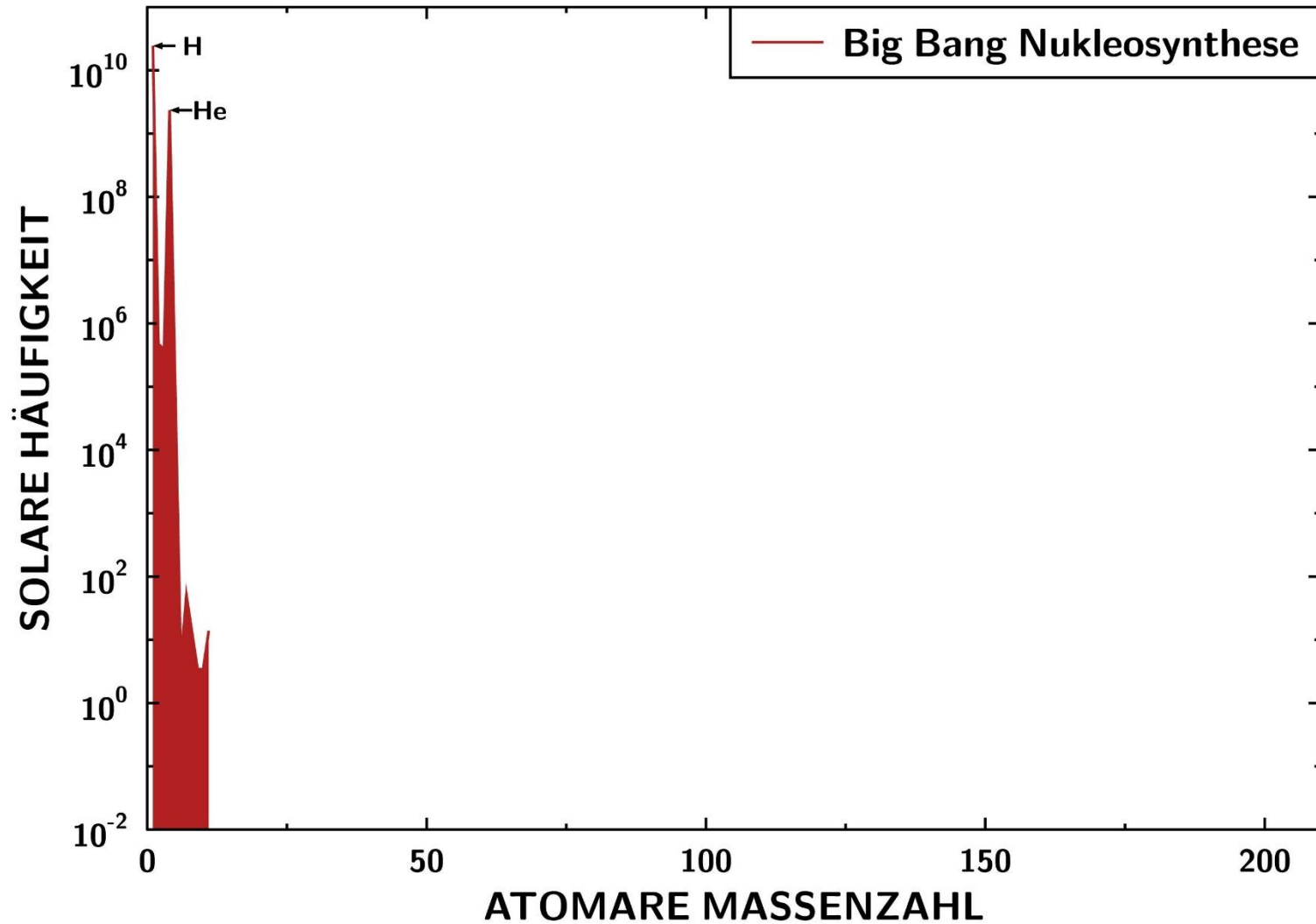
-> **homogene Ausdehnung**

# Urknall – Big Bang



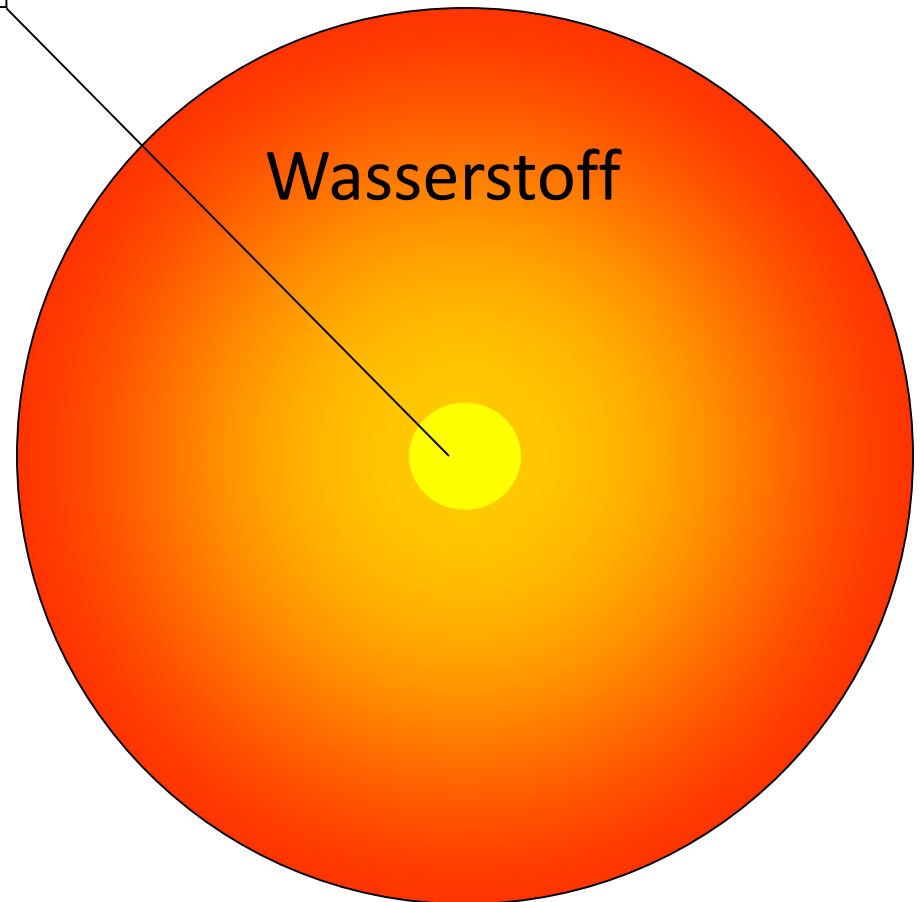
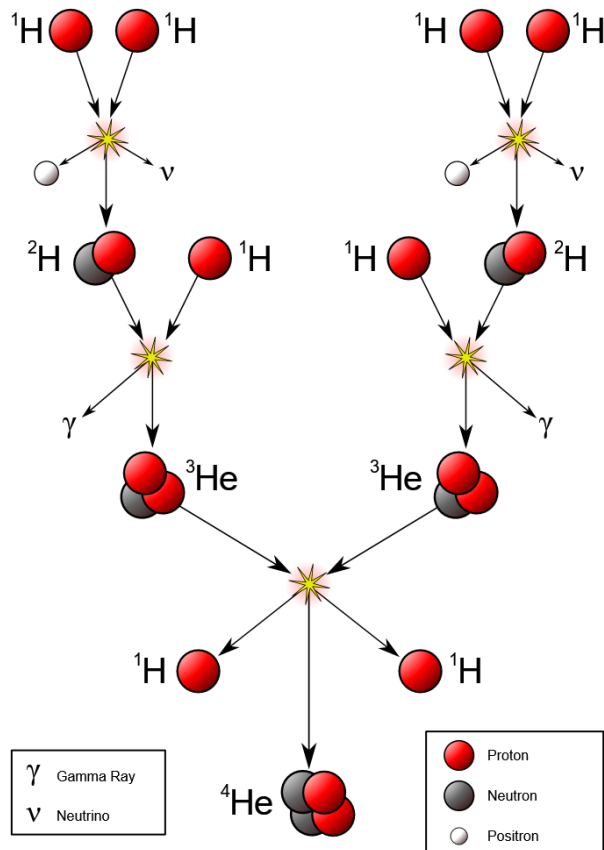


# Erste Elemente – H, He

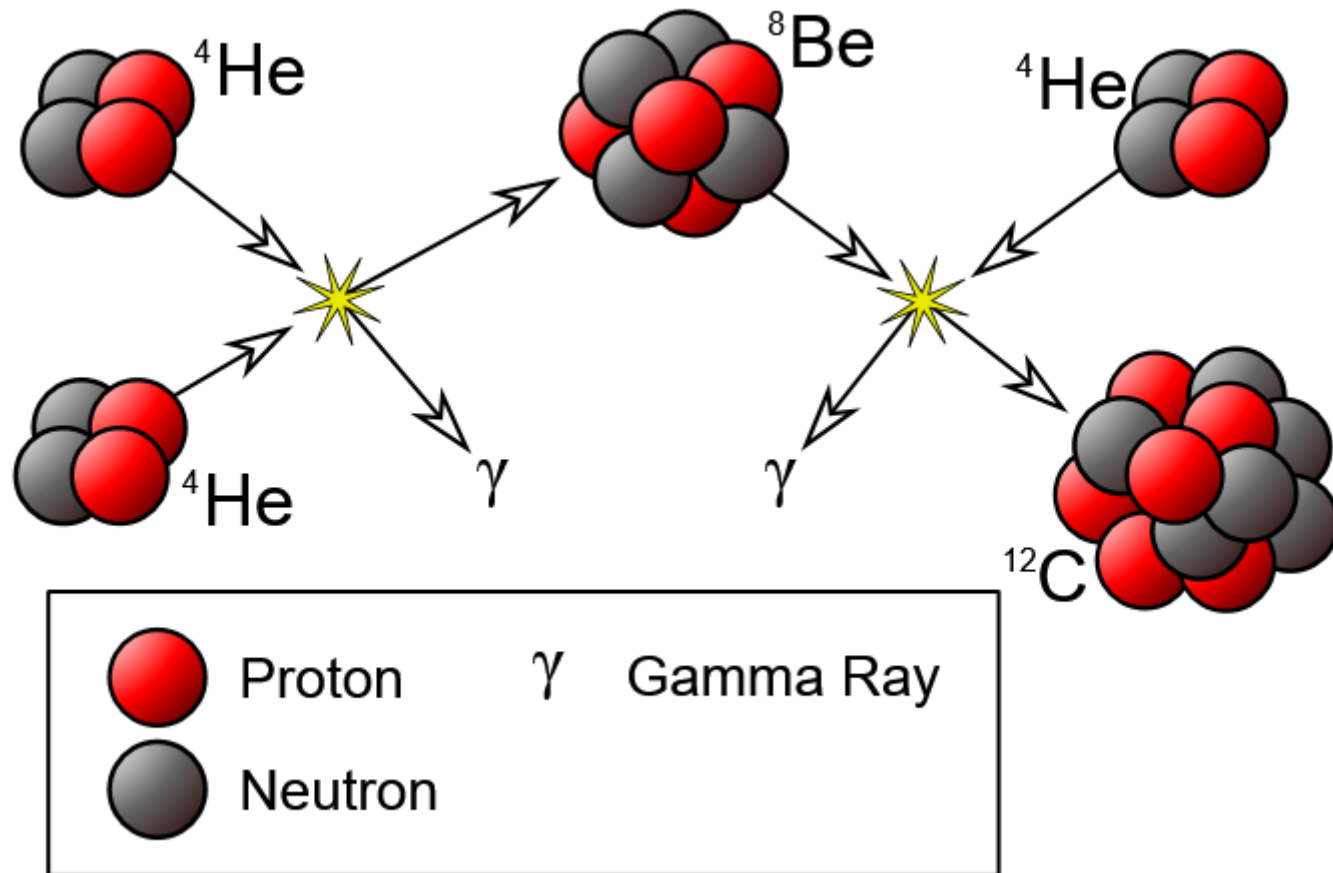


# Erste Sterne nach 500 Millionen Jahren

## Wasserstoffkernbrennen

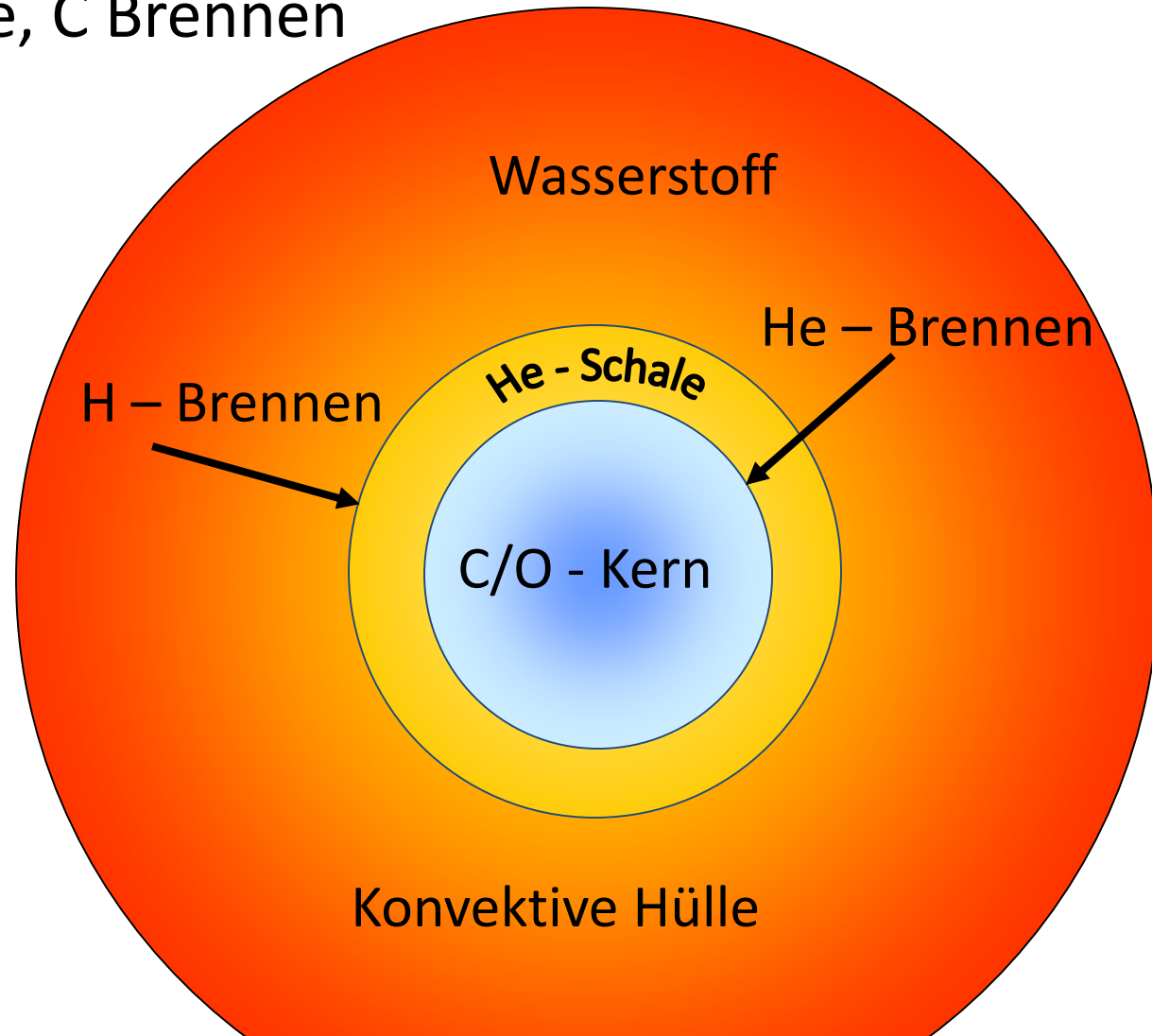


# Triple-Alpha-Prozess

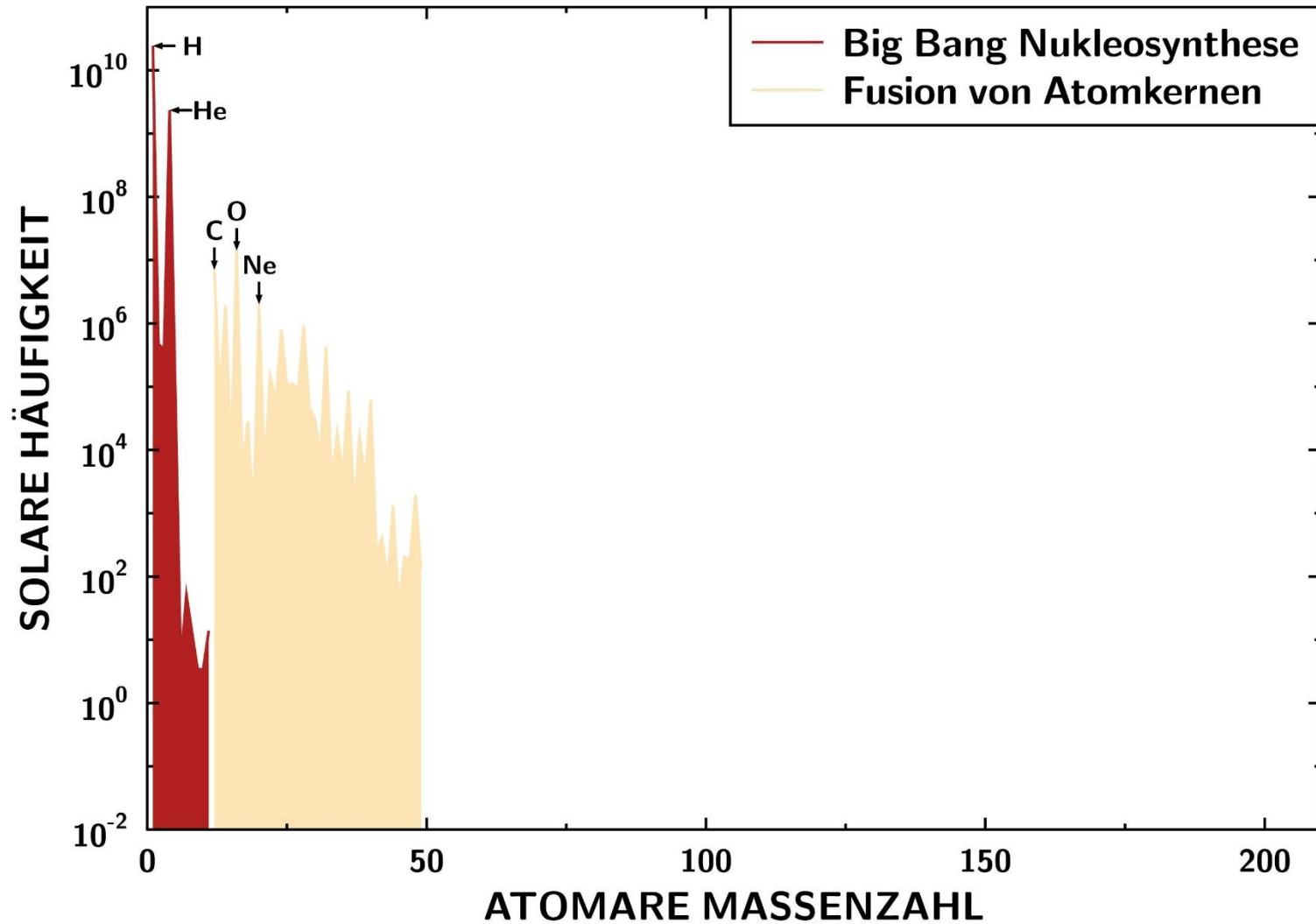


# Zwiebelschalenstruktur

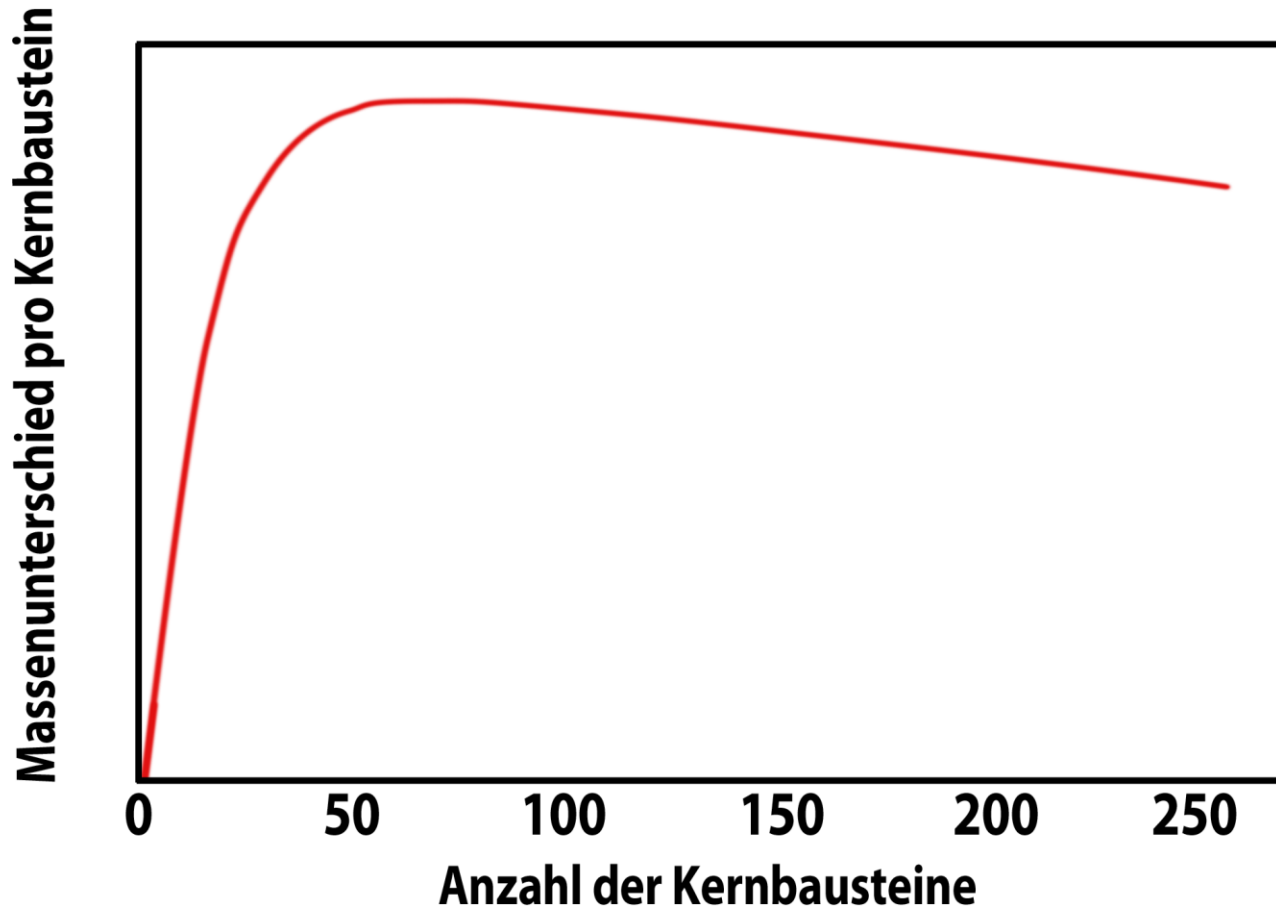
Spätere Stadien: H, He, C Brennen



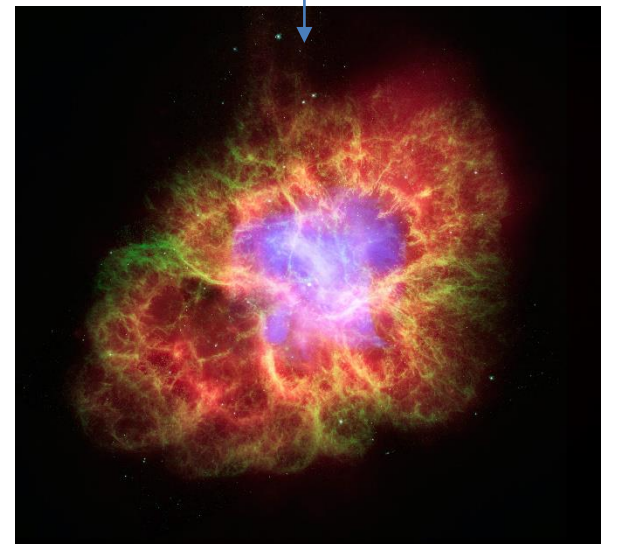
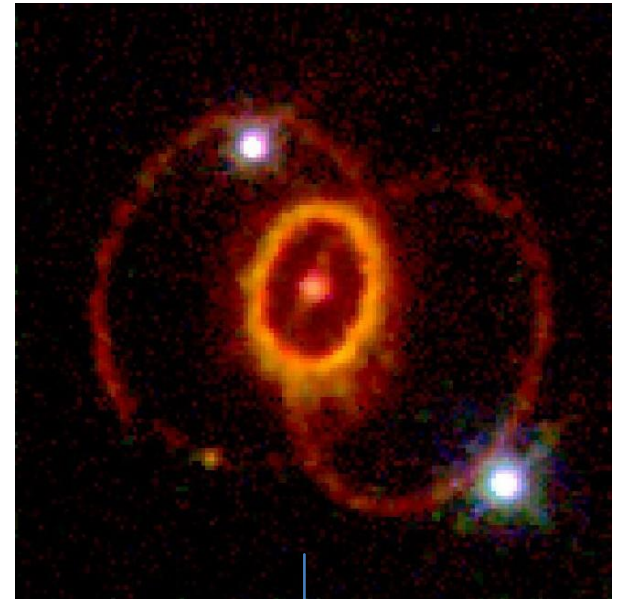
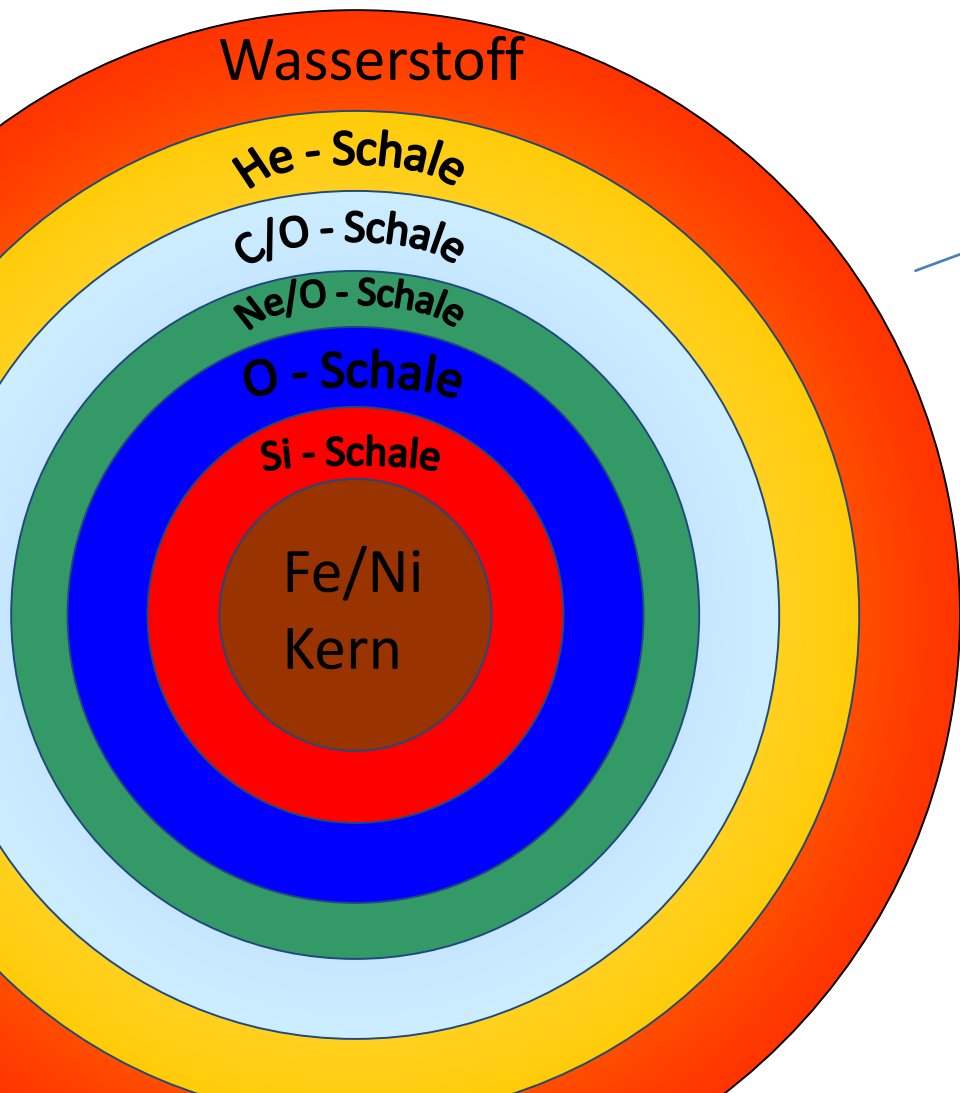
# Energiequelle der Sterne



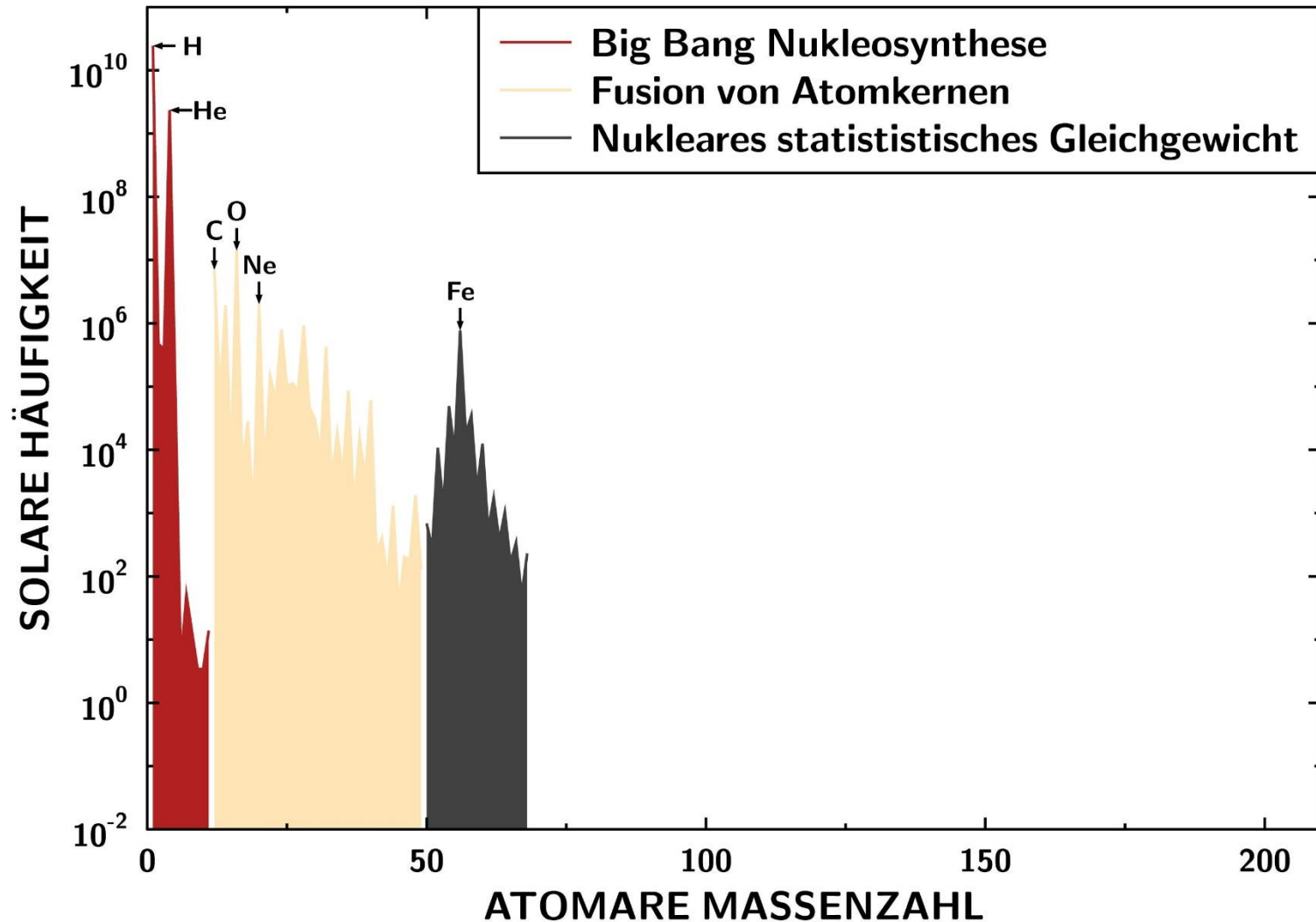
# Nukleare Bindungsenergie



# Schwere Sterne – frühes Ende

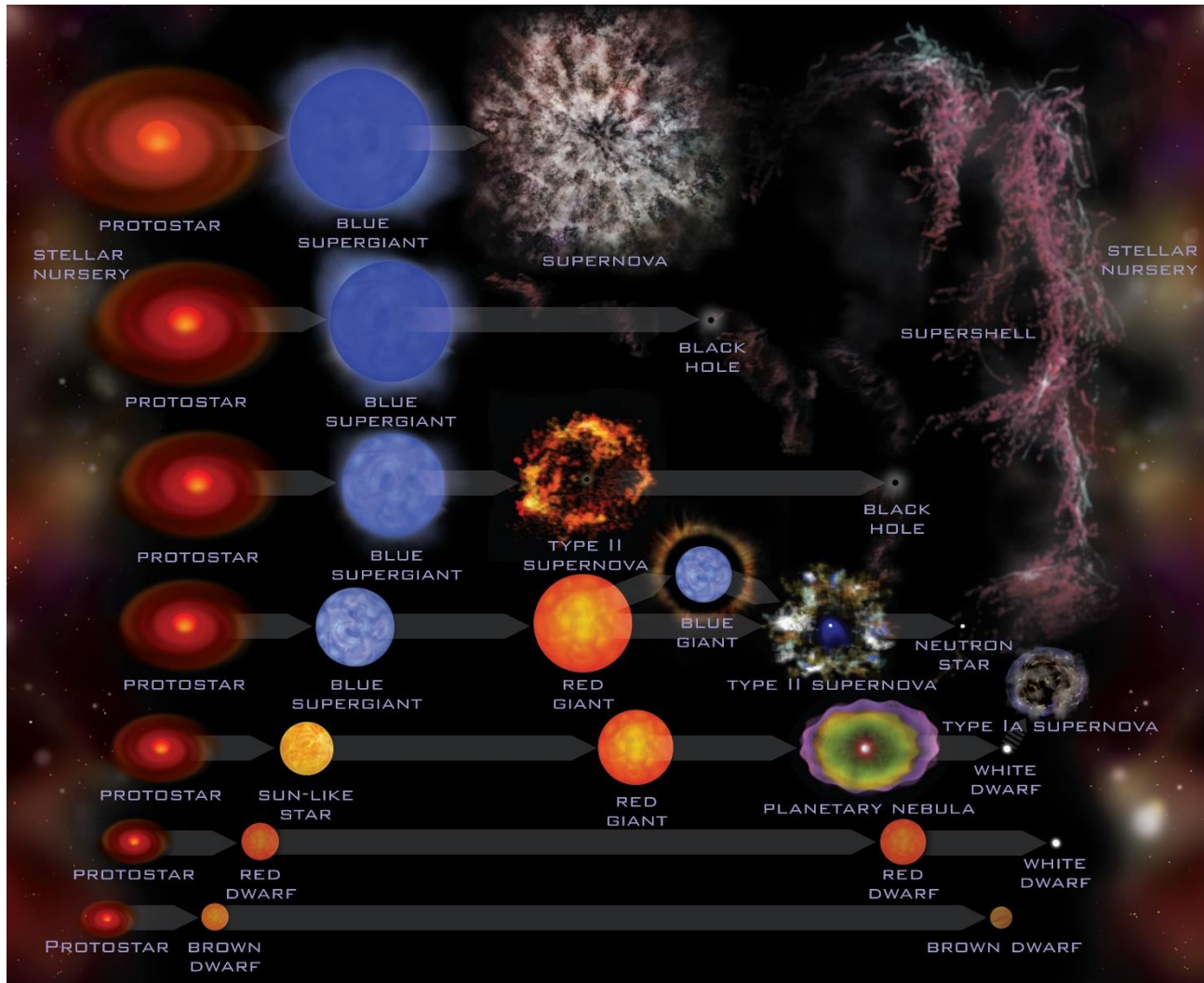


# Eisen – die stabilsten überleben

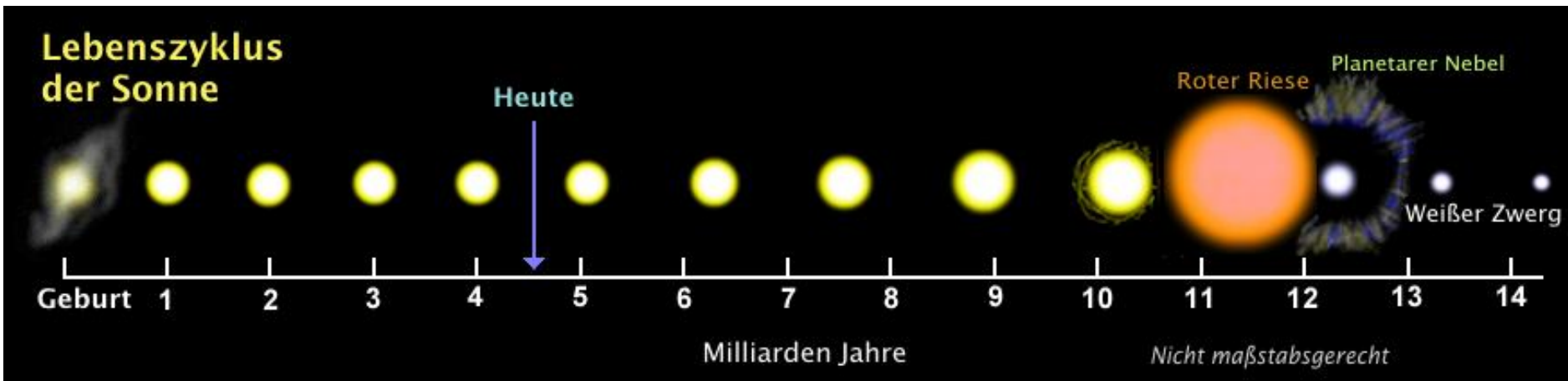




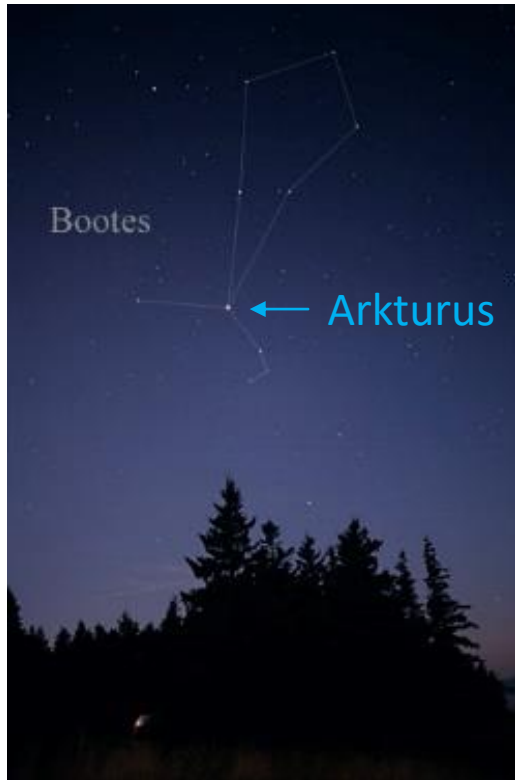
# Masse bestimmt Schicksal



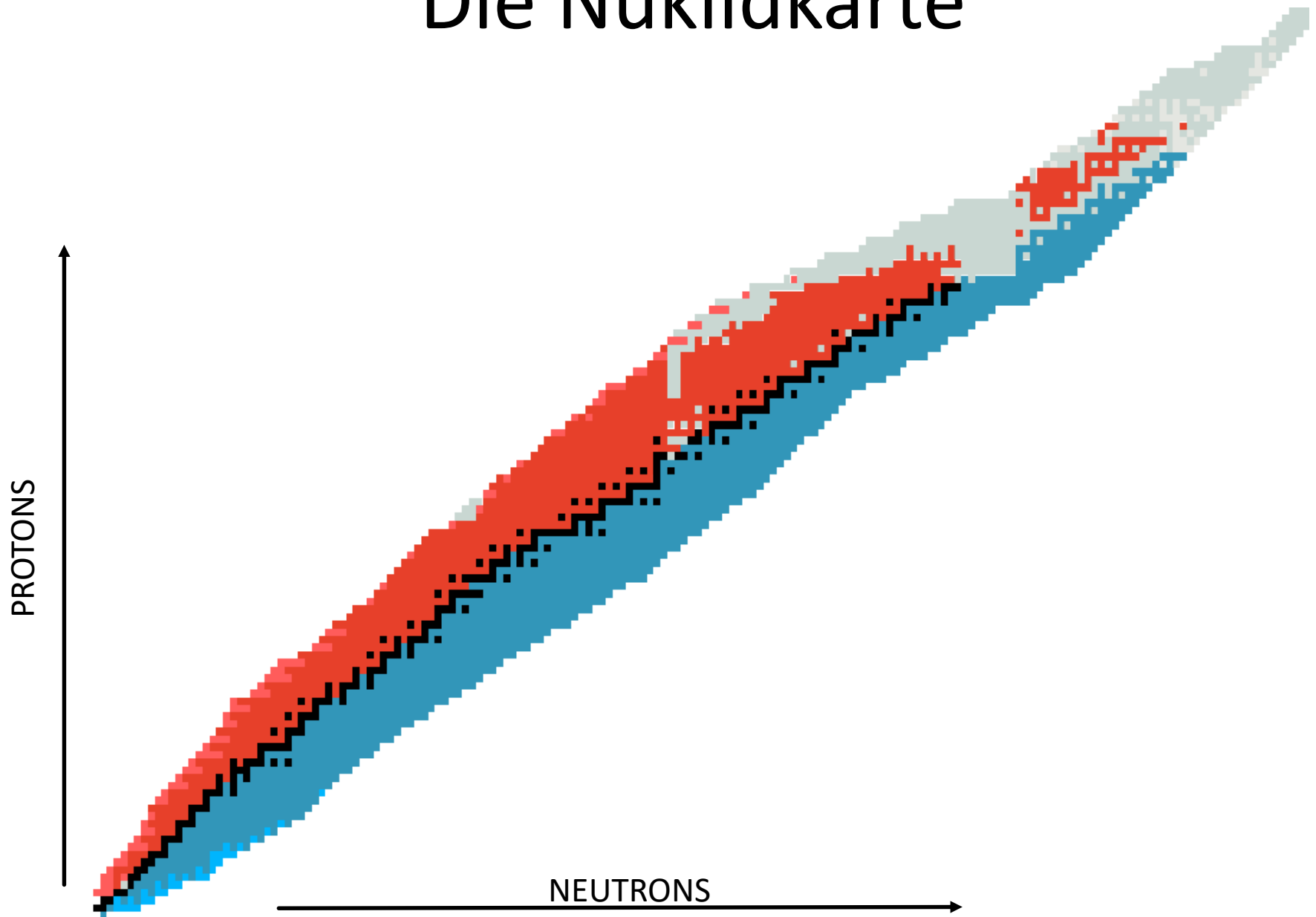
# Das Schicksal der Sonne



# Das Geheimnis der Roten Riesen



# Die Nuklidkarte



# Technetium in Roten Riesen



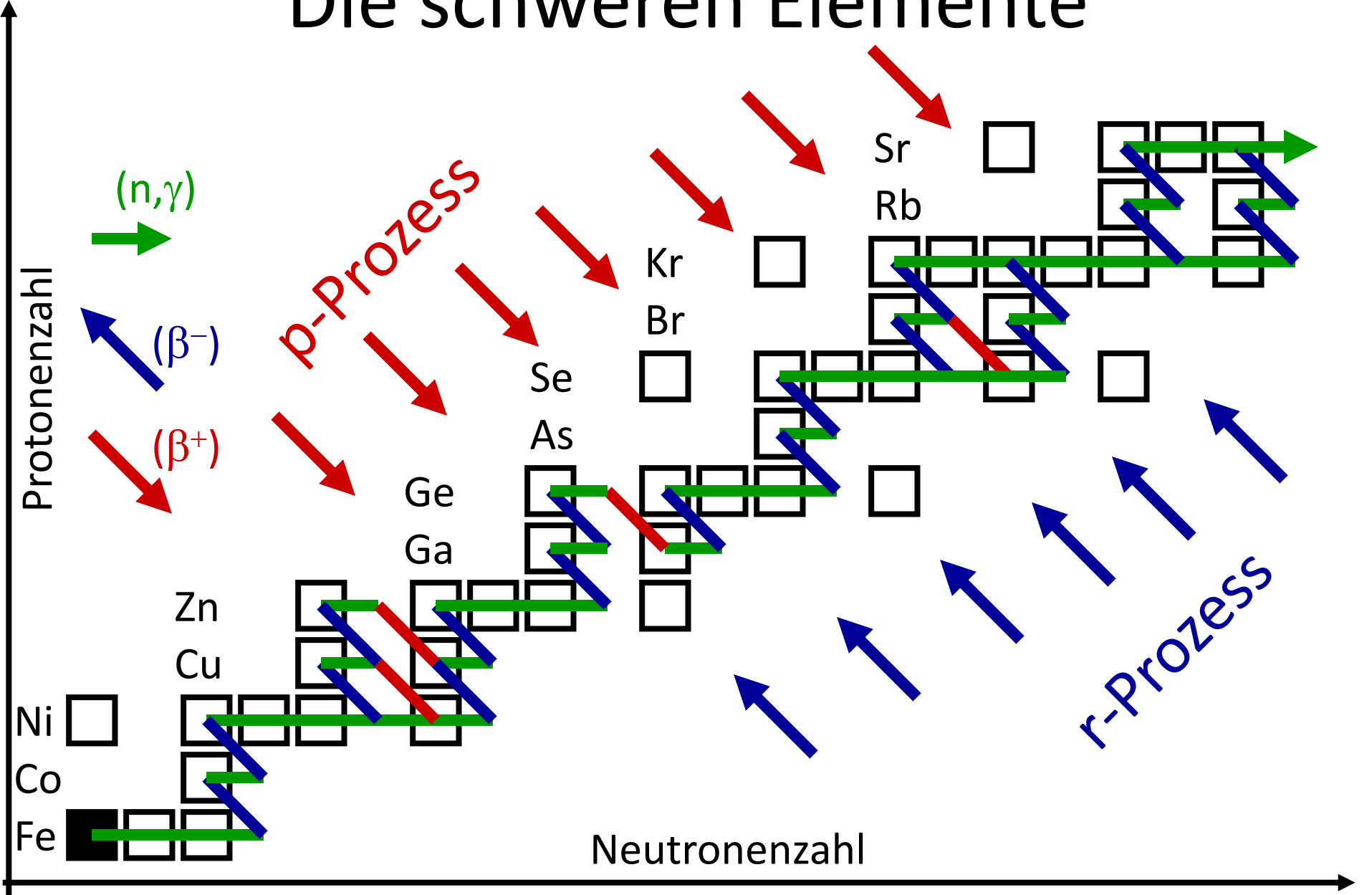
**Sterne  
produzieren die  
schweren  
Elemente!**

PROTONS

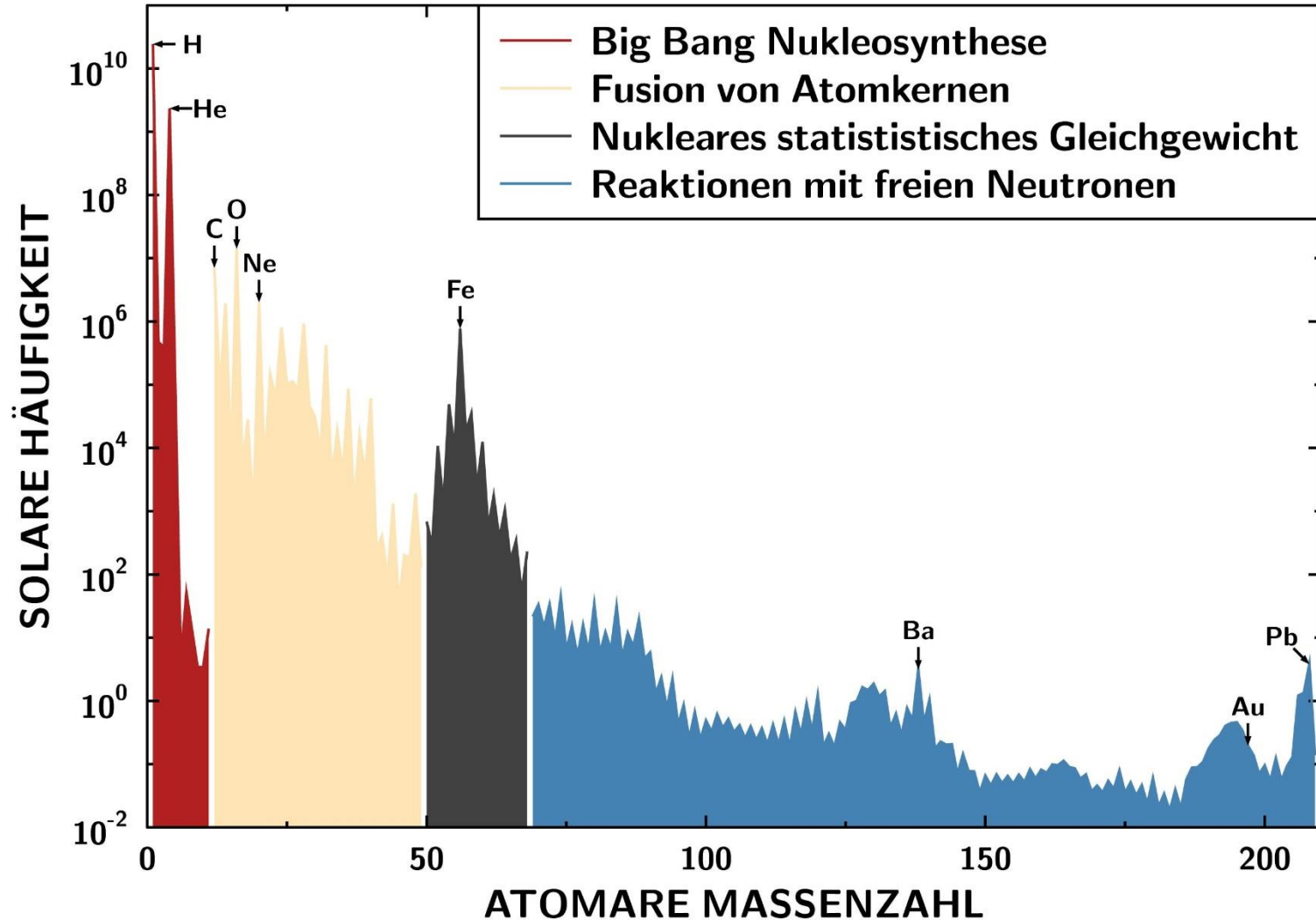


NEUTRONS

# Die schweren Elemente

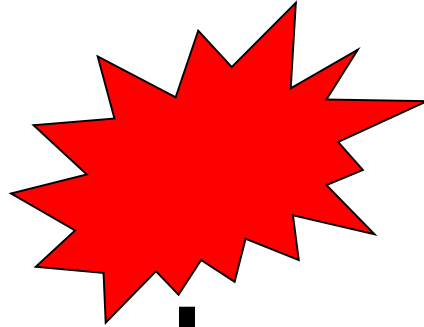


# Die Entstehung der Elemente



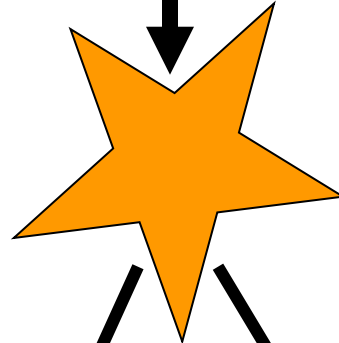
# Kosmisches Recycling

Urknall



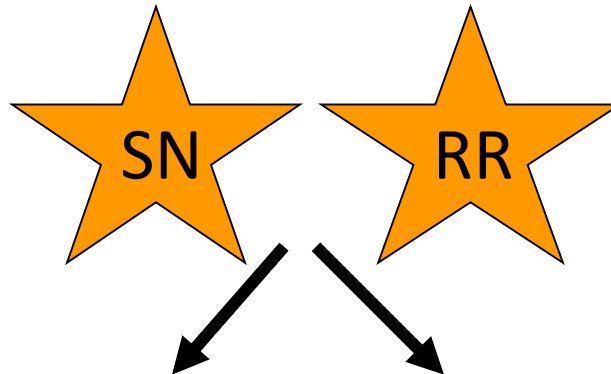
H, He, Li

Erste Generation  
von (schweren)  
Sternen



C ... Fe  
Eisengruppe, einige  
schwere Elemente

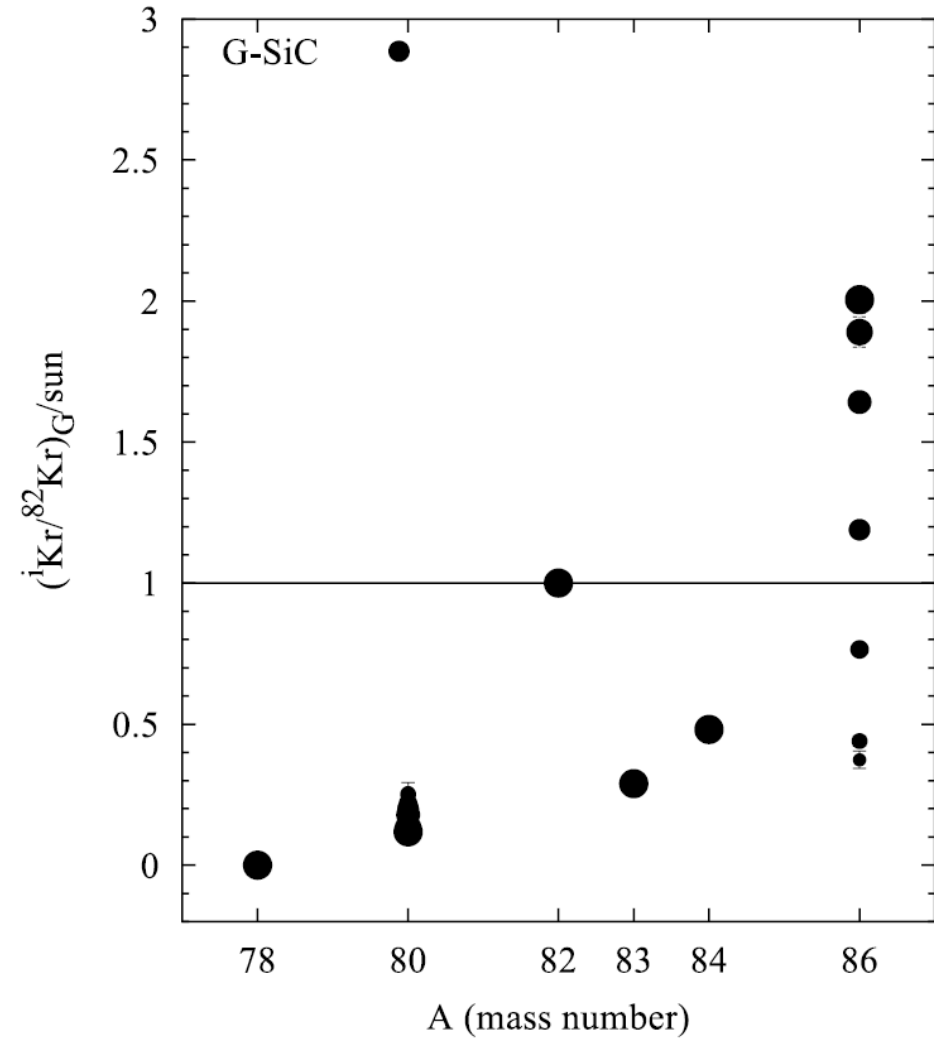
Spätere Stern-  
generationen



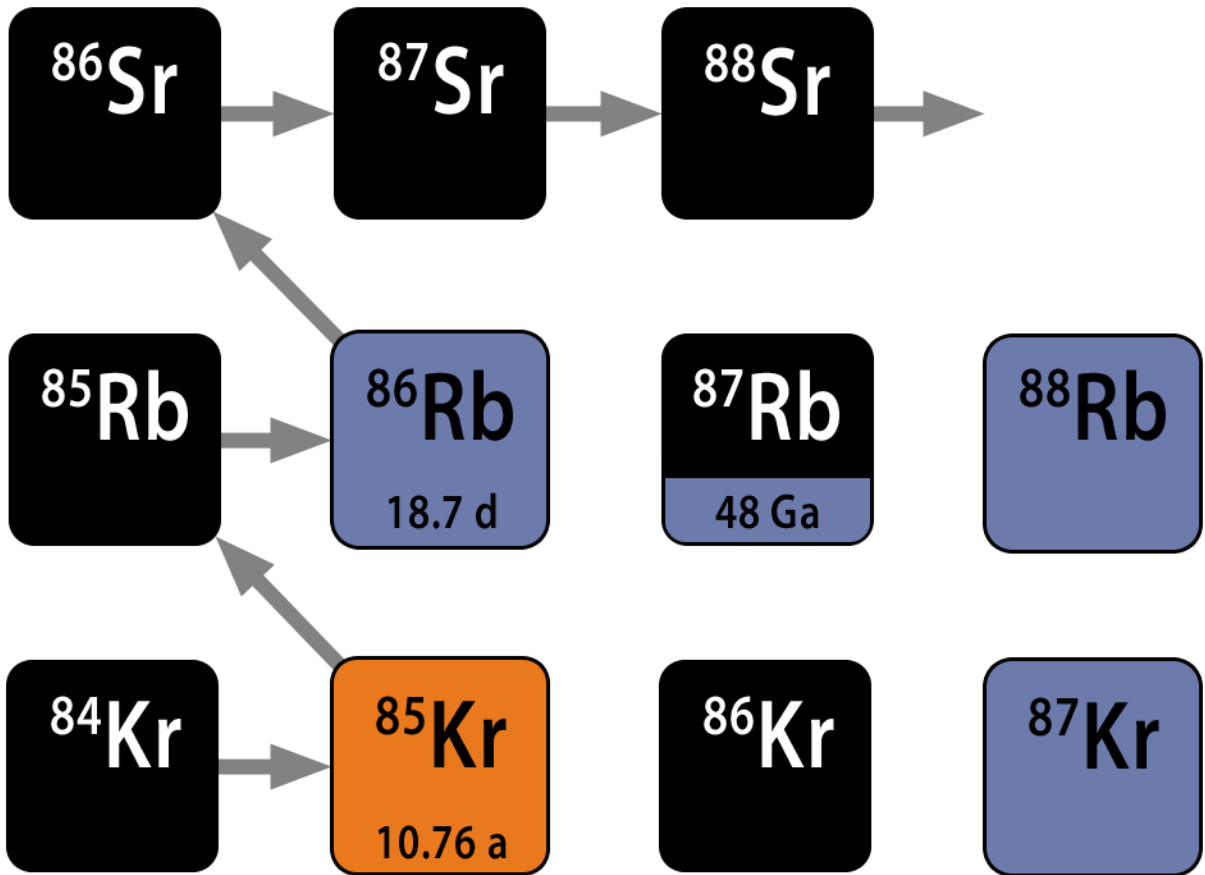
C ... Fe  
Eisengruppe,  
weitere  
schwere Elemente



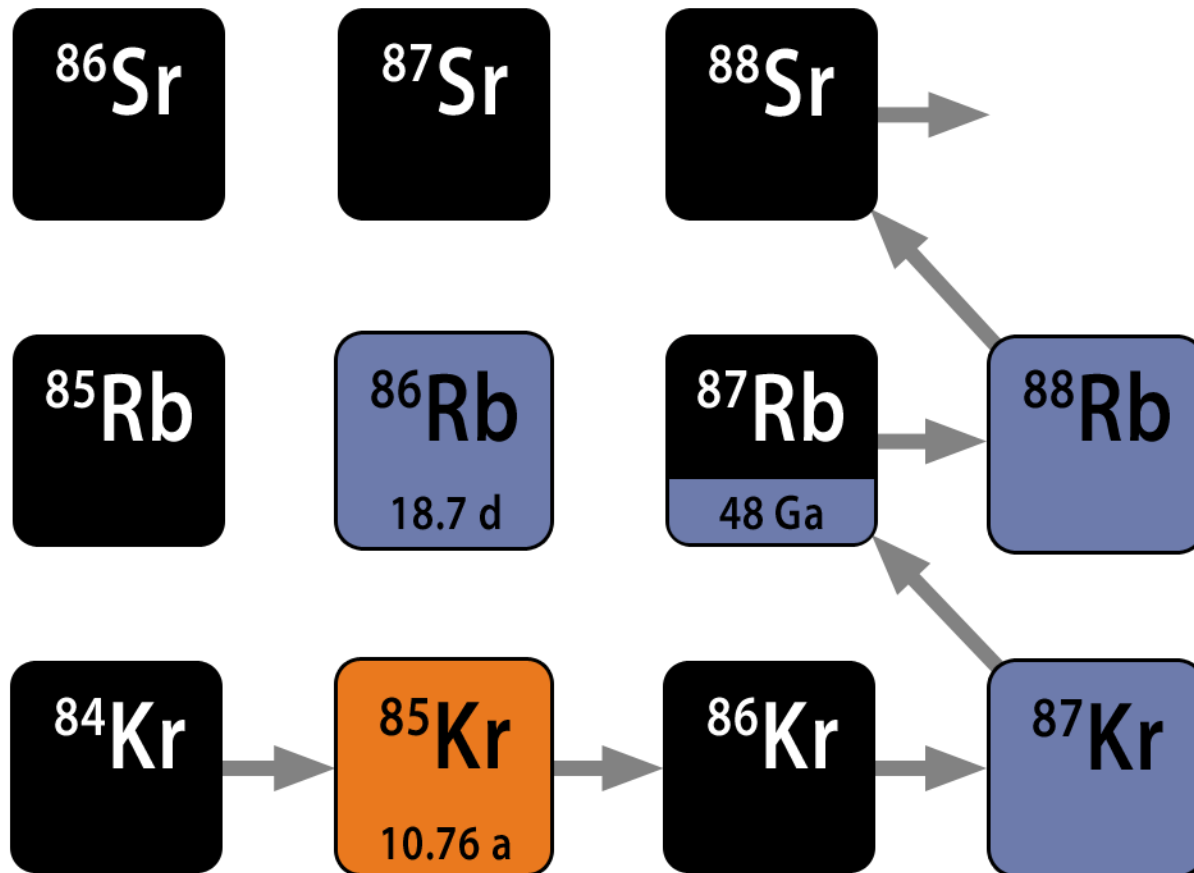
# Meteoriten und kosmischer Staub



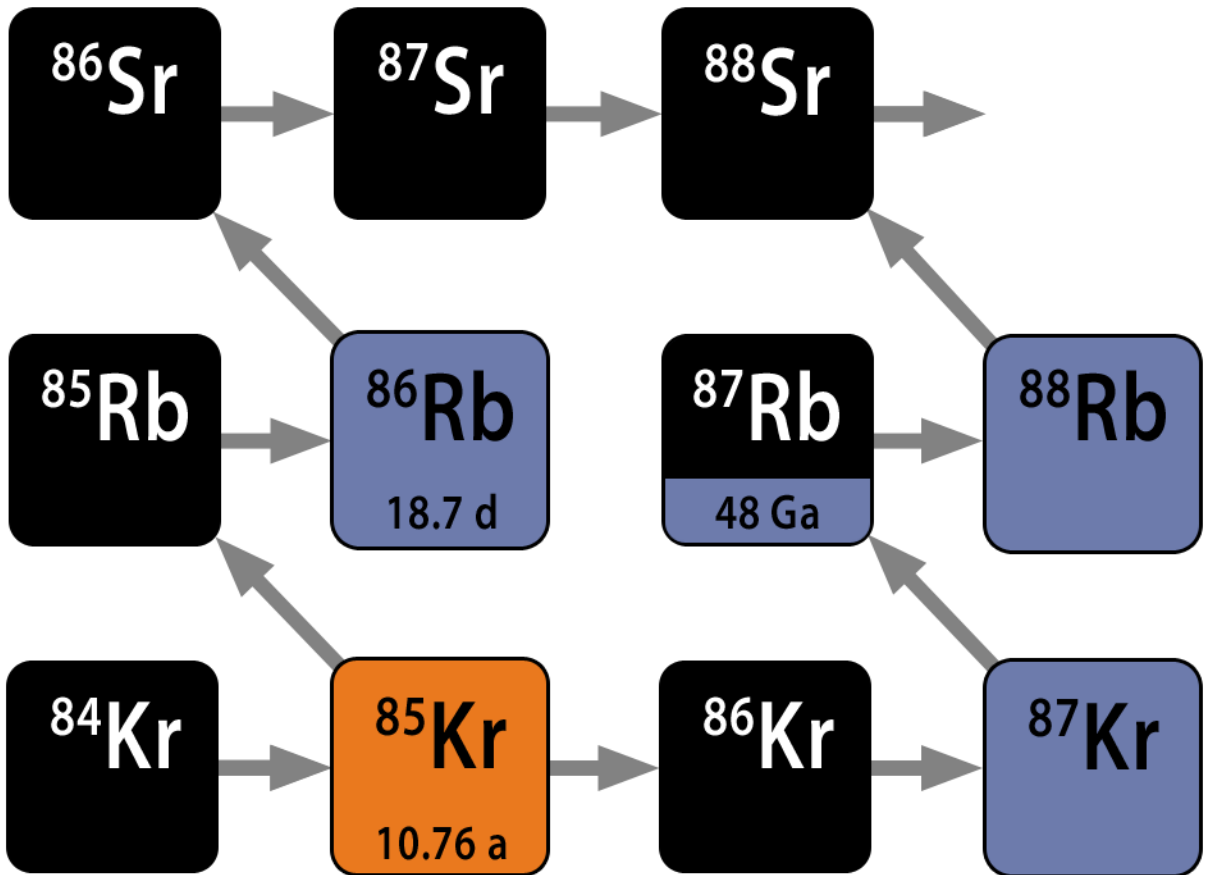
# Verzweigungen im Pfad



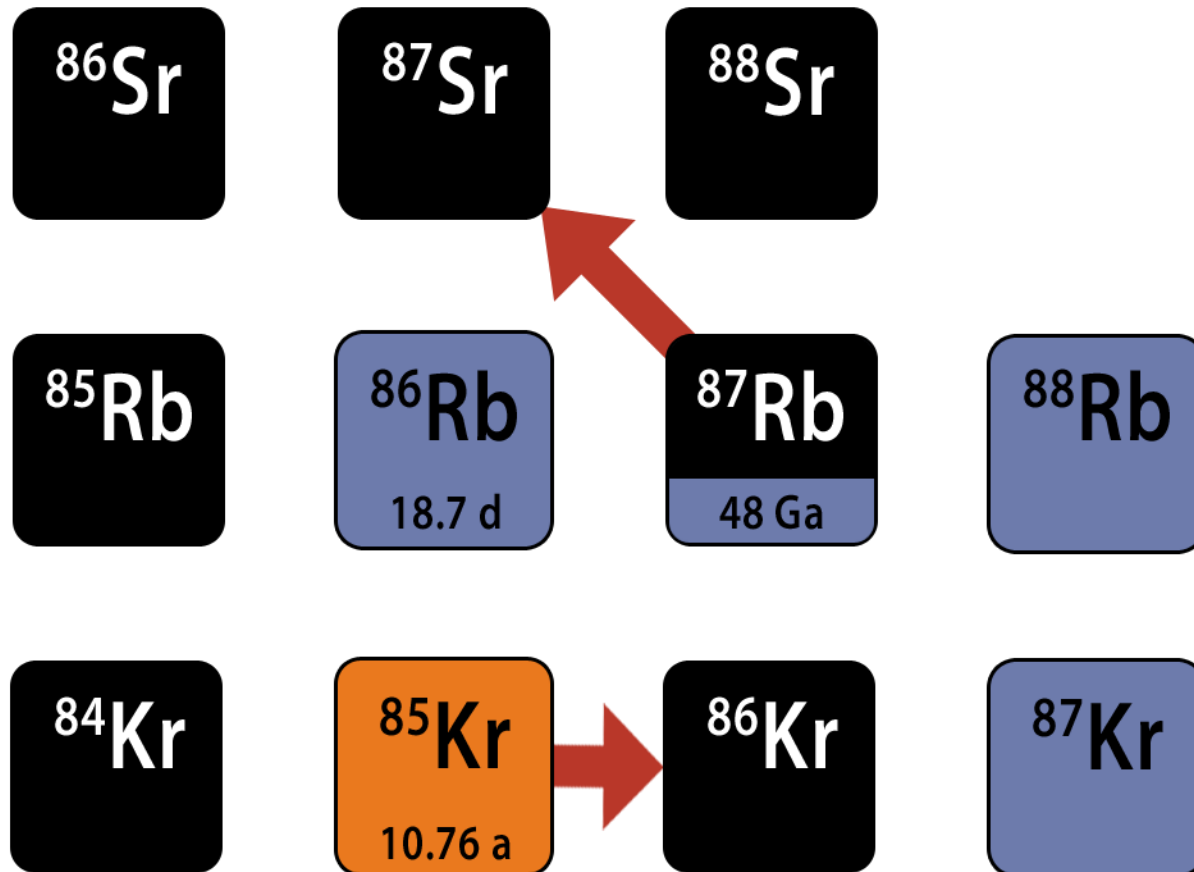
# Verzweigungen im Pfad



# Verzweigungen im Pfad



# Wichtigste Unbekannte: Neutroneneinfang am $^{85}\text{Kr}$



# Wann begann die Welt?

