Pi & Planck

THE BIG IDEA

Noether's Theorem

Every continuous symmetry of a physical law hides a conserved quantity.

SYMMETRY ↔ CONSERVATION

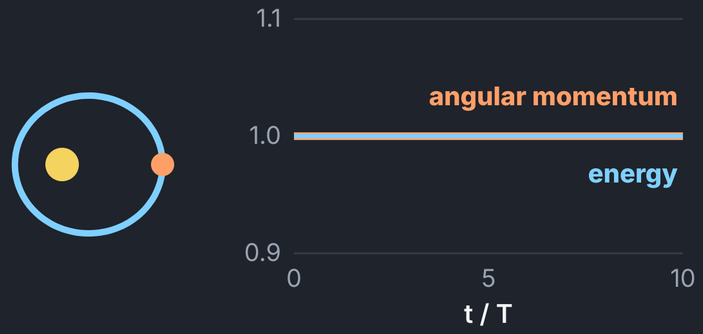
$$\frac{dQ}{dt} = 0$$

Shift in space
same law here and there
⇒ **Linear momentum**

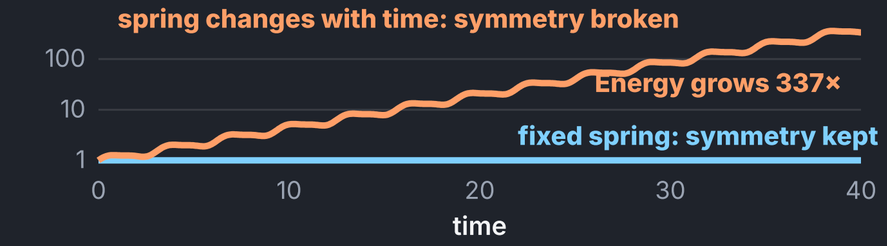
Rotate
same law in every direction
⇒ **Angular momentum**

Shift in time
same law today and tomorrow
⇒ **Energy**

CHECK IT IN CODE



L and E stay constant · Worst drift in 10 orbits: about 10^{-12} relative



EMMY NOETHER

1882 Born in Erlangen, Bavaria

1907 Doctorate in Erlangen, summa cum laude (dissertation published 1908)

1915 Invited to Göttingen by Hilbert and Klein

1918 Publishes "Invariante Variationsprobleme"

1933 Moves to Bryn Mawr College, USA

1935 Dies at Bryn Mawr, 14 April

1918 Göttingen Nachrichten, pp. 235–257. English translation by Tavel (1971), pp. 183–207.

3 classic cases: space shift, rotation and time shift give momentum, angular momentum and energy.

108 years since Noether published the theorem (1918 to 2026).

Sources: E. Noether, *Nachr. Ges. Wiss. Göttingen, Math.-phys. Kl.* 1918:235–257 · M. A. Tavel transl., *Transp. Theory Stat. Phys.* 1:183–207 (1971), arXiv:physics/0503066 · MacTutor (St Andrews), Noether biography · CCNY Graduate Classical Mechanics, Lecture 7