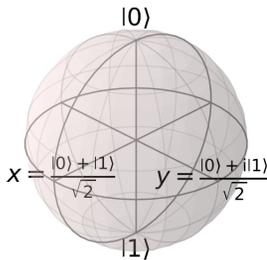


Atom-light interaction

- Rabi oscillation = rotation by Ωt about x-axis on Bloch sphere
- $\Omega t = \pi/2 \equiv \blacksquare$
- $\Omega t = \pi \equiv \blacklozenge$
- $p^\mu = \hbar(\frac{\omega}{c}, \mathbf{k})$ transferred \Rightarrow states separate spatially

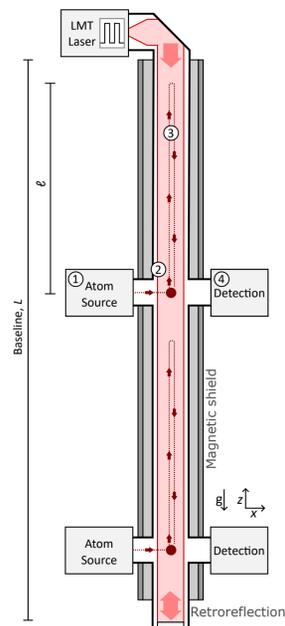
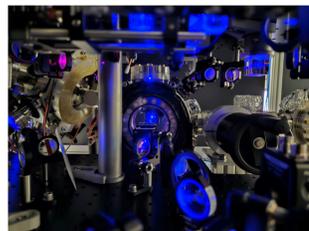


Differential atom interferometry

- Same laser pulses \Rightarrow same $\Delta\phi_{\text{internal}} + \Delta\phi_{\text{laser}}$
- Difference in $\Delta\phi_{\text{propagation}}$ remains
- Gravitational waves, ultralight dark matter \Rightarrow time-dependent differential phase

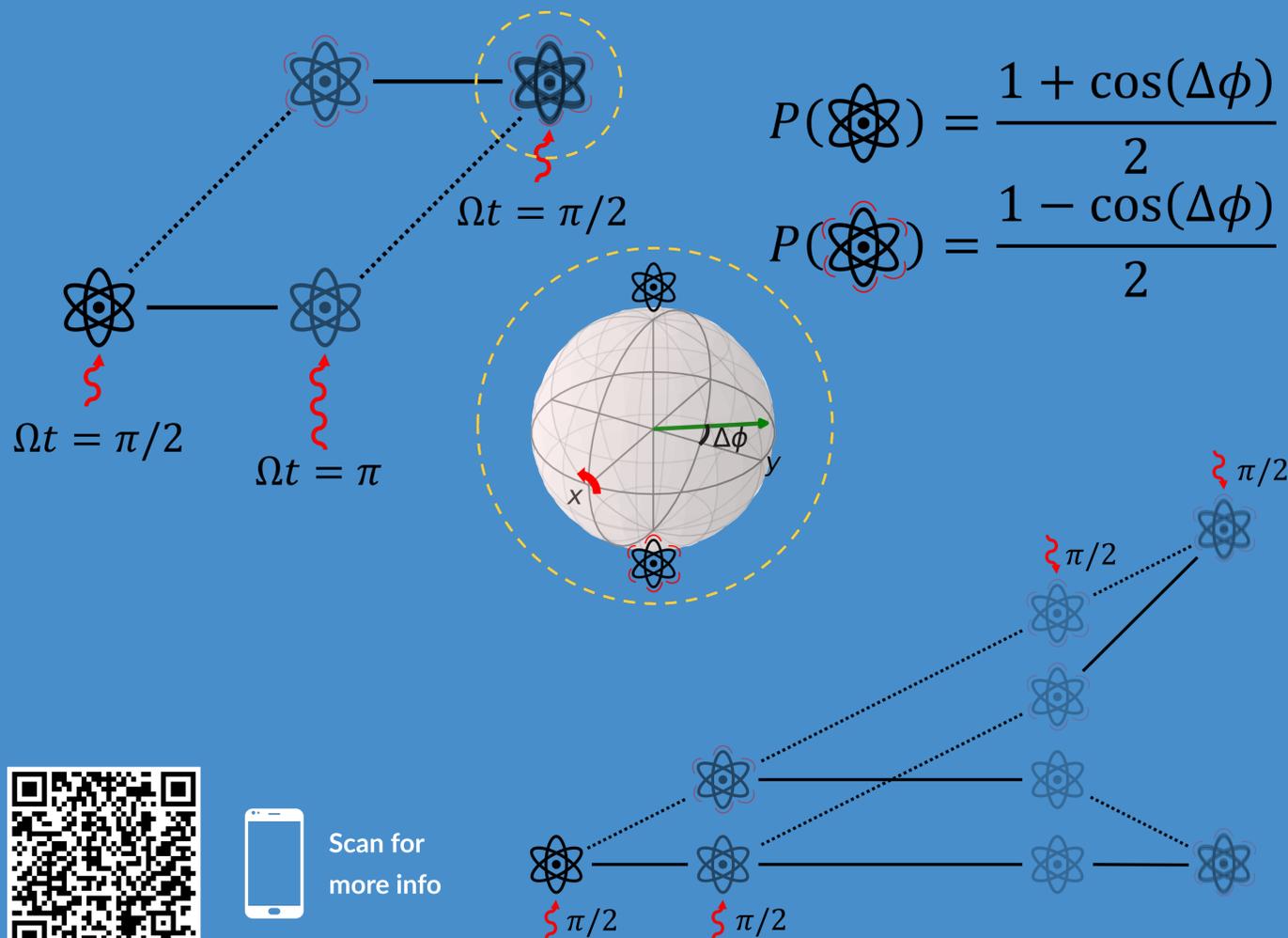
AION collaboration

- Atom Interferometer Observatory & Network
- Differential atom interferometry with ultracold Sr on clock transition
- AION-10: 10 m tower to be built @ Oxford



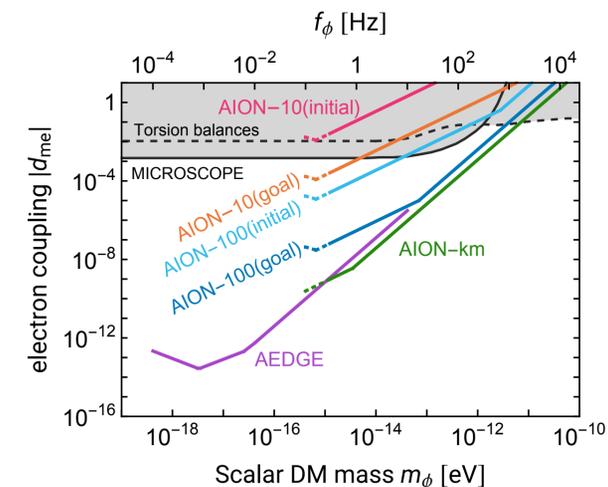
An atom in two places at once is a nifty quantum sensor

$$\Delta\phi = \Delta\phi_{\text{propagation}} + \Delta\phi_{\text{internal}} + \Delta\phi_{\text{laser}}$$

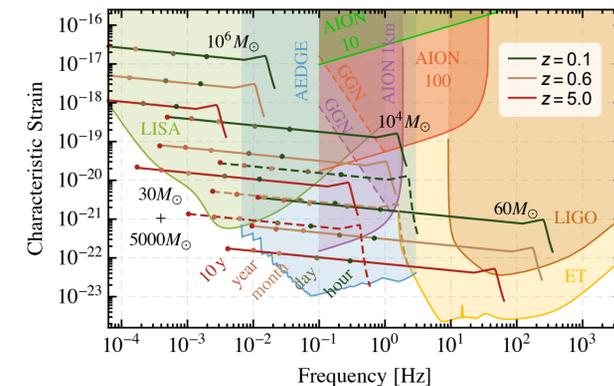


Scan for more info

Dark matter sensitivity



Gravitational wave sensitivity



Fine structure constant

$$\alpha^2 = \frac{2R_\infty}{c} \times \frac{m}{m_e} \times \frac{h}{m}$$

- Highest precision test of QED
- Ramsey-Bordé scheme (left) measures recoil frequency to determine h/m

