Mini-review of General Relativity (GR)

1. Principle of Equivalence

2. Bending of Light

$$\Delta\theta = \frac{4GM}{c^2 R} \qquad \text{or} \qquad \Delta\theta = 1.76\,\text{arcsec for light near sun}$$

3. Gravitational Lensing

4. Black Holes – light can not escape for $R < R_{\rm sch}$

$$R_{\rm sch} = \frac{2GM}{c^2}$$

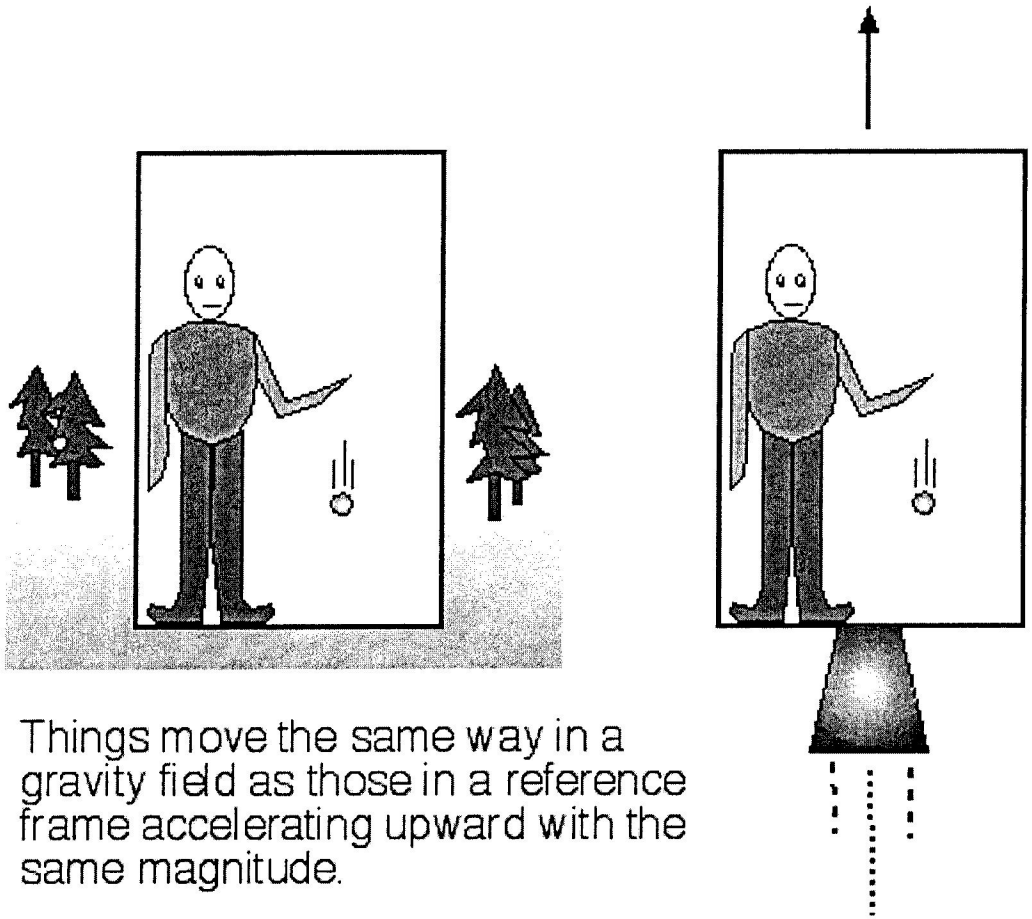
5. Precession of Perihelion of Mercury – see here. The GR contribution is

$$\frac{\Delta\theta}{\Delta t} \sim \frac{360^o}{88\,\text{days}} \left(\frac{v}{c}\right)^2 \qquad \text{exact calculation gives} \quad \frac{\Delta\theta}{\Delta t} \simeq 43\,\text{arcsec/century}$$

6. Today. Gravitational Red-shift and applications

Equivalence Principle

- There is no experiment a person could conduct (in a small volume) that can distinguish gravitational forces from accelerated motion.



Things move the same way in a gravity field as those in a reference frame accelerating upward with the same magnitude.

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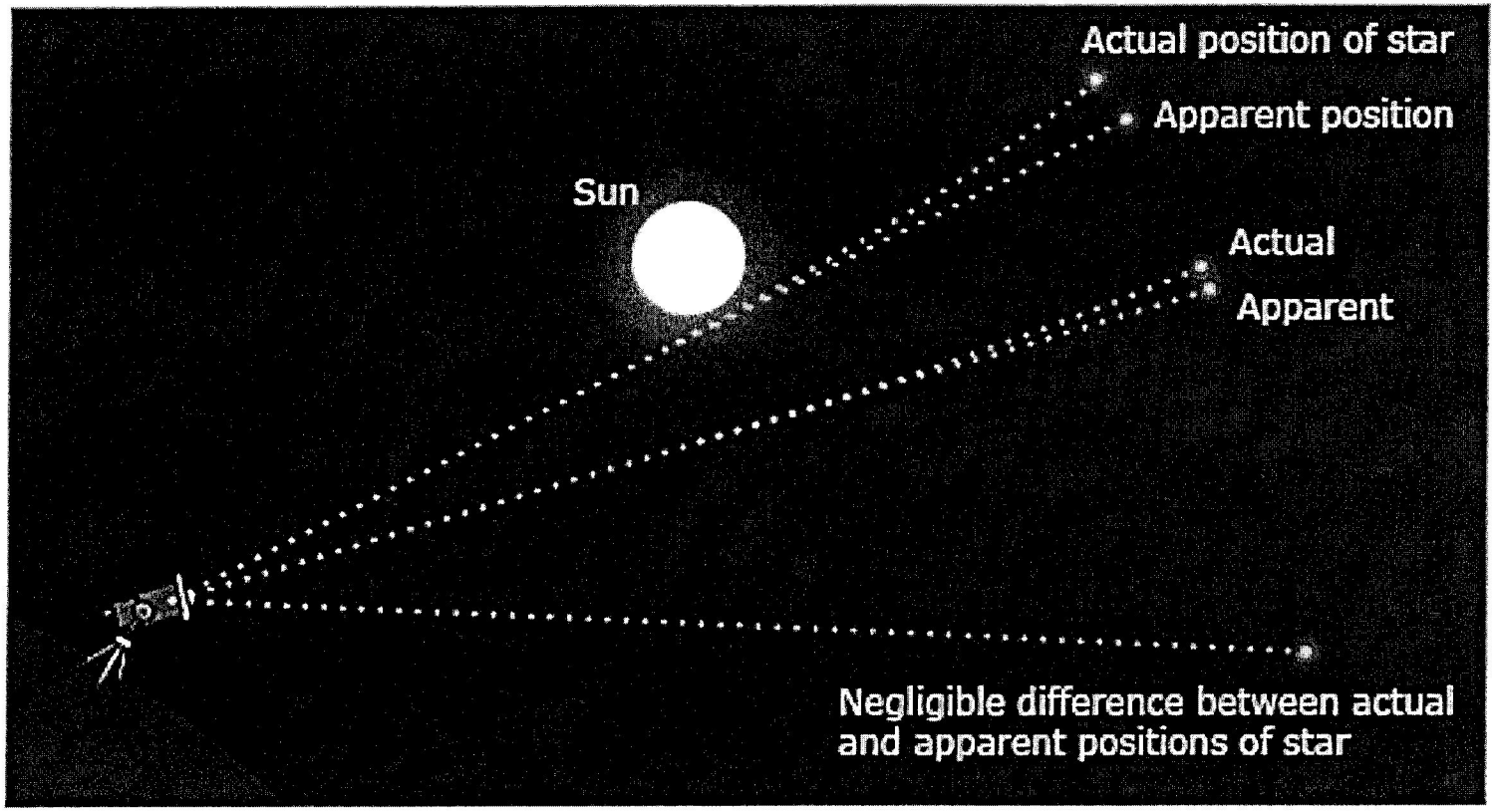
Measuring the bending of light

- Measure the deflection of starlight as it goes near the sun
- Compare angles between the stars during a solar eclipse, and at night at a different time of the year



source http://undsci.berkeley.edu/article/0_0_0/fair_tests_04

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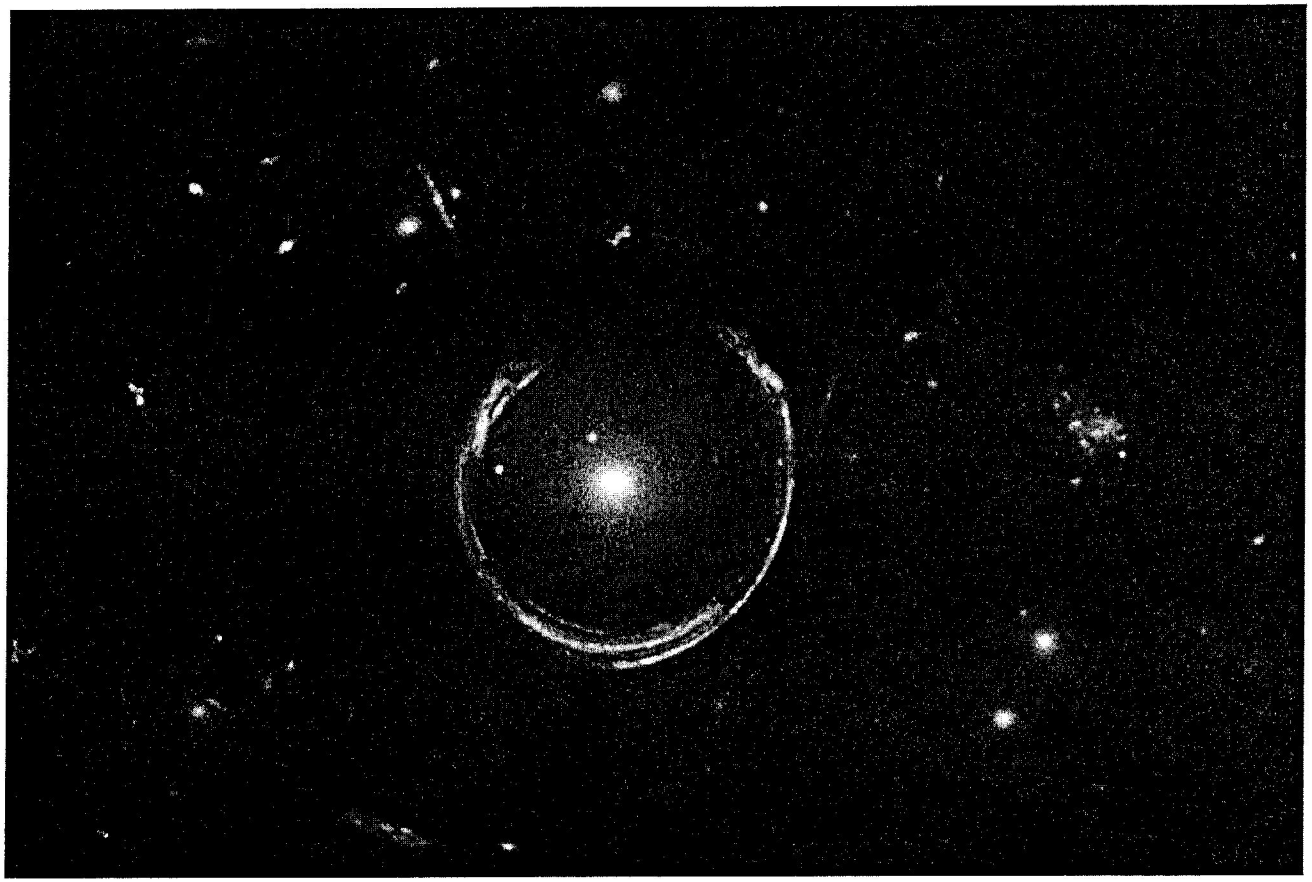
Gravitational Lensing in Observational Astronomy



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