
The Detection of Gravitational Waves

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Caltech Board of Trustees

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LIGO

Introduction

- Laser Interferometer Gravitational Wave Observatory
 - » **DIRECT** Detection of Gravitational Waves
- Joint Caltech/MIT Project funded by the National Science Foundation
- Under Construction
 - » Two Sites -- Louisiana and Washington



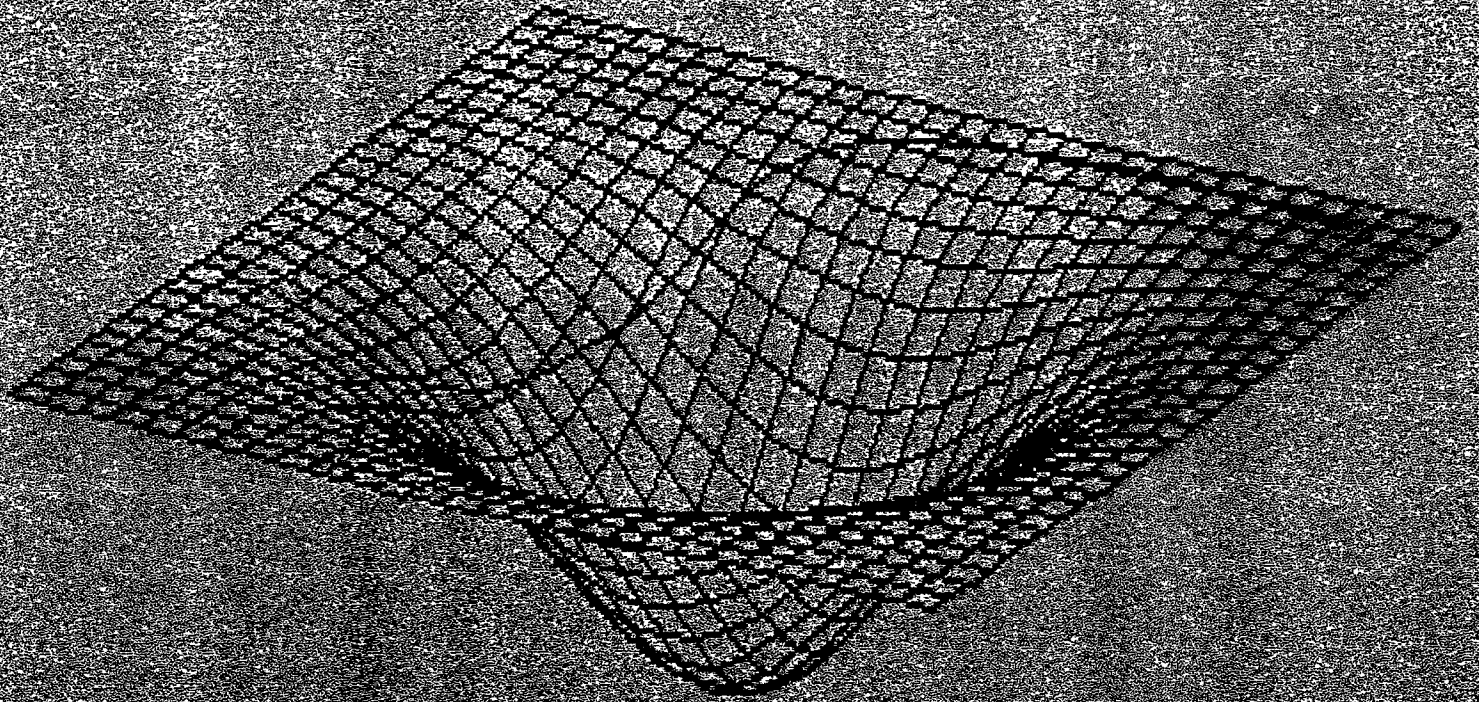
The Science

- Newtonian Gravity has instantaneous action at a distance
 - » a problem
- Einstein general relativity theory describes gravity as due to curvature of space-time
 - » evidence - bending of light rays; gravitational lensing
- The fluctuating fields give gravitational waves that propagate at speed of light
 - » evidence - Hulse Taylor experiment
- **LIGO**: Laser Interferometer Gravitational Wave Observatory
 - » Direct detection of gravitational waves

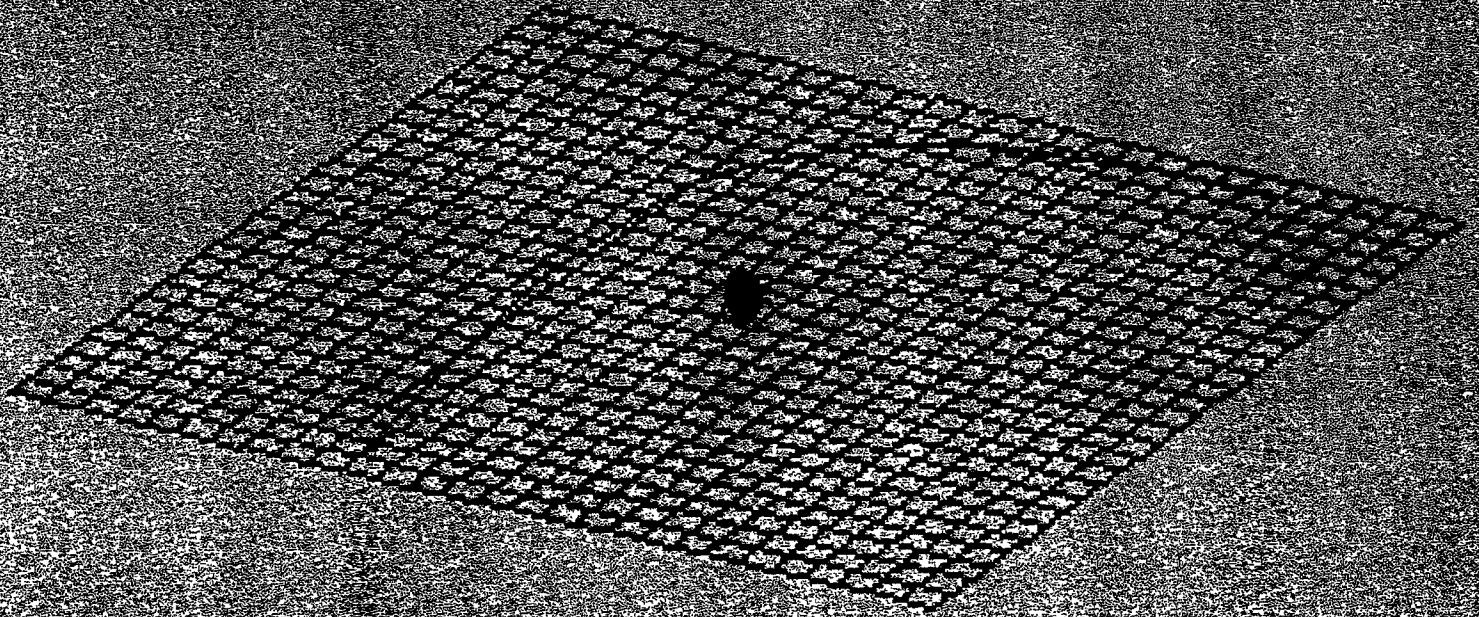


Matter tells space how to curve, and space tells matter how to move

Einstein

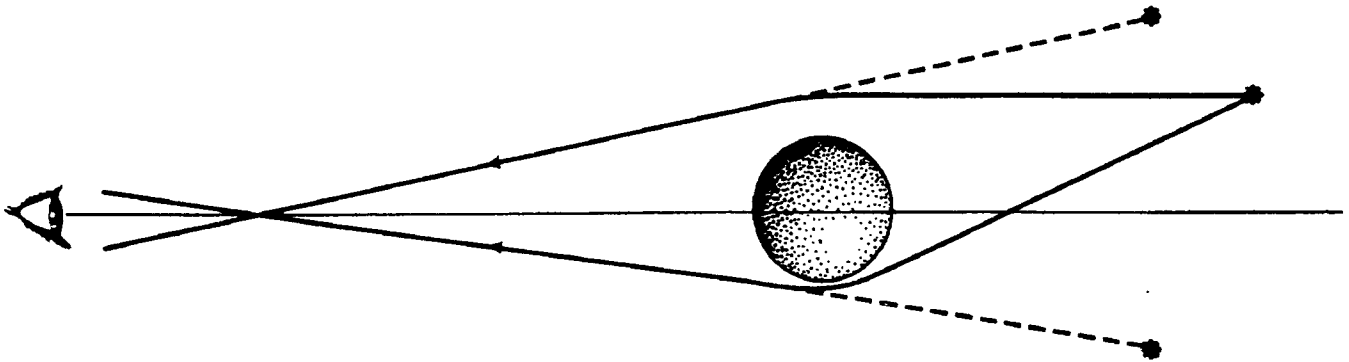


Newton

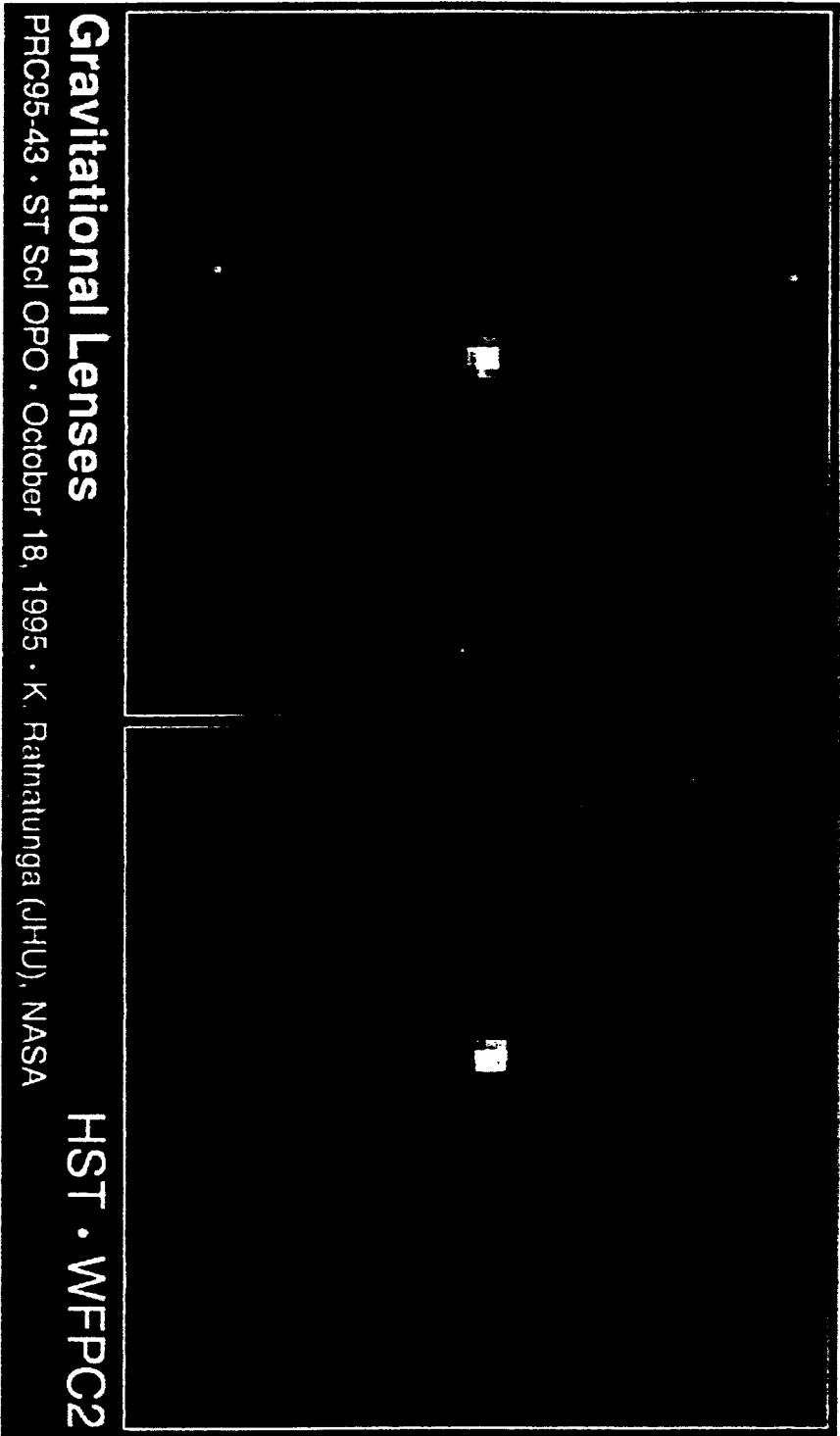


Gravitational Lenses

bending of light rays



- Multiple images from deflection of light rays in gravitational fields
- Stars or galaxies producing such images are called *gravitational lenses*
- Not true lenses, since deflection angle *decreases* with impact parameter, therefore no well-defined focal length
- Can detect '*dark matter*'



Gravitational Lenses

PRC95-43 · ST Sci OPO · October 18, 1995 · K. Patnalonga (JHU), NASA

HST · WFPC2

Compact Binary Objects

curvature of space-time

