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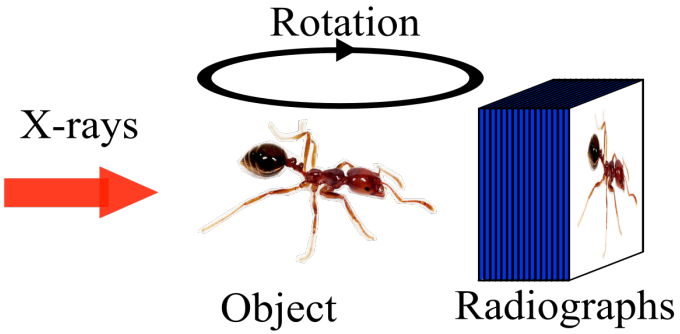
X-ray imaging

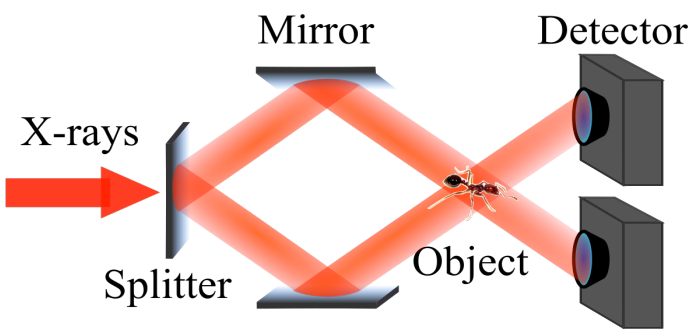
First Virtual Workshop on PORTHOS Science Case – September 11th, 2020

Ultrafast 3D imaging at XFELs

Machine key parameters
- Energy: 12.4-30 keV
- 5 fs (FWHM)
- 100 Hz repetition rate
- Linear Polarisation
- Self-seeding, one color

- **2D** imaging is **in general not sufficient** to determine **mechanical properties** of a system unless it is 2D or trivial
- **3D** imaging is crucial to determine the **structure** and **mechanics** of physical systems
- **XFELs** provide a high number of **photons per pulse**
  - This enables **new imaging modalities** such **diffraction-before-destruction**
- Current diffraction-before-destruction approaches can only retrieve **3D information** of **reproducible samples** and **processes**.
  - They **preclude** the study of **non-reproducible samples** and **stochastic processes**
- We propose **X-ray multi-projection imaging** a single-shot 3D approach





P. Villanueva-Perez, Optica ***5****, 1521-1524 (2018)*

- Potential PORTHOS applications:
  - **Ultrafast 3D** studies of dynamical processes with **pump-and-probe**
  - Acquisition of **3D information of stochastic and non-reproducible samples** in diffraction-before-destruction modality
  - Study of **ultrafast phenomena** by using the beam-splitter setup for **split-and-delay experiments**