Detecting Tidal Disruption Events (TDEs) with the *Einstein Probe*

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Einstein Probe

➤ Features & advantages

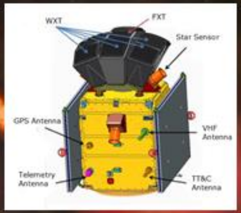
- ✓ survey capability (grasp): MPO lobster-eye focusing technology offers unprecedentedly large combination of field-of-view (~1 steradian) and detection sensitivity, making it the most powerful X-ray all-sky monitor superceding any other missions by 1-2 orders of magnitude
- ✓ passband: 0.5-4 keV
- ✓ spatial resolution: ~4arcmin FWHM
- ✓ response time: capable of issuing transient alerts rapidly
- ✓ survey strategy: five pointings per orbit, each of 11min exposure; cover half of the (night) sky in three orbits
- ✓ capability of follow-up observations: quick follow-up observations of newly-discovered transients with the narrow-field X-ray MPO telescope by slewing the satellite to the target position

Stars are tidally disrupted and accreted when they approach supermassive black holes (SMBHs) closely, producing a flare of electromagnetic radiation. The majority of the TDEs identified so far (approximately 20-25; review by Komossa 2012) have been discovered by their **luminous, transient X-ray emission**. Once TDEs are detected in much larger numbers, in future dedicated transient surveys, a **wealth of new applications** will become possible.

Here, we describe the **proposed X-ray mission *Einstein Probe***, which aims at detecting TDEs in large numbers. The mission consists of a wide-field micro-pore Lobster-eye imager (60deg x 60deg, or ~1 ster), and is designed to carry out an **all-sky transient survey** at energies of 0.5-4 keV. It will also carry an X-ray telescope of the same micro-pore optics for follow-ups, with a smaller field-of-view. It will be capable of issuing public transient alerts rapidly.

Einstein Probe

➤ Mission design:



➤ Status: EP was selected as one of the "mission candidates for advanced study" under the CAS "Priority Strategy Space Science Programme" in 2013. The Advanced Study Phase has started in 2014.

Einstein Probe

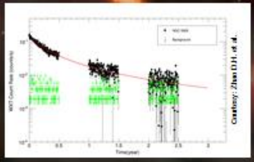
➤ Science Objectives:

- time-domain census of soft X-ray transients and variable sources in the universe
- uncover quiescent black holes over all astrophysical mass ranges, and other compact objects
- search for, and locate, electromagnetic counterparts of gravitational-wave (GW) sources

➤ Satellite Specifications / Payloads

- ✓ Orbit: 600km, circular, <30° inclination
- ✓ Mass: 380 kg Life time: 3+2 years (expected ~2020)
- ✓ Payloads 1. wide-field (60° x 60°) monitor based on lobster-eye micro-pore optics (MPO) technology
  2. narrow-field follow-up X-ray telescope with larger area

expected rate of tidal disruption events with *Einstein Probe*:
~ several 10s – 100 events/year



simulated Einstein Probe (Wide Field Telescope) TDE lightcurve, assuming a TDE as in NGC 5905, observed with ROSAT (Komossa & Bade 1999).

new science and applications:

- well covered lightcurves (left) constrain BH mass & spin, and enable detection of super-massive binary BHs (e.g., Liu et al. 2014)
- TDE rate measurements, in dependence of host galaxy type
- search for IMBHs
- rapid multi-wavelength follow-ups
- new probes of GR and accretion physics