**Course title:**

Quasars as cosmological probes

**Duration [number of hours]:  12**

**PhD Program [MERC/MPS/SPACE]: SPACE**

**Name and Contact Details of Unit Organizer:**

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**Course Description [max 150 words]:**

Quasars are a class of astrophysical sources with a central role in cosmology: their formation in the first few hundred million years from the Big Bang is a challenge for the current models of structure formation; their radiation probably played a major role in the reionization era; their interplay with the host galaxy shaped the history of star formation in galaxies and their own growth history. Finally, they can be used as "standard candles" to probe the expansion of the Universe up to $z\sim7$.
I will discuss the general properties of quasars, the accretion models, the wind/outflow models, the interactions with the host galaxies, and the methods to derive their distances.

**Syllabus [itemized list of course topics]:**

1. Introduction: phenomenology of quasars: Spectral Energy Distribution, Energy budget, spectroscopic properties from the infrared to the X-ray band. Identification of quasars, big catalogs.
2. The central engine of quasars: accretion disks, X-ray emission.
3. Quasar evolution and feedback: supermassive black holes at high z, ultra-fast outflows, molecular outflows. The interaction between quasars and host galaxies; the role of quasars in galaxy evolution.
4. Quasars as cosmological standard candles: reverberation mapping, Eddington-limit accretors, the X-ray to UV relation.

**Assessment [form of assessment, e.g. final written/oral exam, solutions of problems during the course, final project to be handed-in etc.]:**

To be defined

**Suggested reading and online resources:**

1. Lectures slides
2. Proposed literature references