

## **Ay215: Seminar course on stellar black holes**

**Rationale:** Much progress has been made for white dwarfs (Gaia) and neutron stars (radio and X-ray). Much of our knowledge of Galactic stellar black holes is derived from a handful of high mass X-ray binaries (e.g. Cygnus X-1) and about fifty low mass X-ray binaries (e.g. A0620-00). However, in some ways, an unexpected avenue was opened up by routine detection of mergers of stellar mass black holes by gravitational wave (GW) interferometers. The extreme masses of black holes in GW binaries has dazzled astronomers and befuddled theorists.

**Spirit & Syllabus:** The spirit of the course is an evaluation of the demographics of stellar black holes bearing in mind anticipated returns from non-traditional approaches (massive radial velocity programs, microlensing, astrometry, faint X-ray & radio sources) followed by expected rich astronomical and physics returns illuminated by discovery of new black hole systems. In our view the course is timely because of massive progress expected from several discovery channels: astrometry (Gaia DR3 in 2022), multiplexed spectroscopy (SDSS Phase V, DESI), microlensing surveys (including ZTF and PGIR), low luminosity binary accreting black holes systems and possibly single stellar black hole binary accreting from the ISM (Spektr RG) and of course GW astronomy (upcoming LVK run O4). We are on the verge of determining or strongly constraining the maximum mass of neutron stars, the minimum mass of black holes and whether black holes regularly populate the pair instability gap. There are hints of exotic black hole systems being formed in nuclear regions of galaxies and of possible electromagnetic detection of coalescence of black holes in AGN disks.

**Eligibility & Schedule:** The course is being offered during the Winter quarter (January 4—March 10, 2021). The schedule will be decided by the *enrolled graduate students*. We will be recording the discussion for sole use of the registered students. We will have two meetings of 90 minutes per week. The slots for these meetings are constrained to be 2-4p (either 2-3:30p or 2:30-4p). Given this boundary condition we would prefer two of Monday/Tuesday/Friday (but, if there is strong reason, we can explore one of Wednesday or Thursday).

We eagerly welcome other participants (e.g. postdocs) provided they commit to the course. We are not accepting casual or occasional participants. Please email [mansi@astro.caltech.edu](mailto:mansi@astro.caltech.edu) if you are interested.

**Structure of the Course:** The course is a mix of seminar & pedagogical style and is offered as P/F. The course has five modules (this may change, depending on the composition of the class). Each module will have a pedagogical lecture by course organizers or an invited expert, assignment of topics for investigation, a presentation by a participant that is scheduled in advance and discussion of the investigations by the entire class.

**Instructors:** M. M. Kasliwal & S. R. Kulkarni