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Invited Lecture

ACCRETION-MODIFIED STARS IN ACCRETION DISKS OF ACTIVE GALACTIC NUCLEI

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Compact objects are expected to exist in the accretion disks of supermassive black holes (SMBHs) in active galactic nuclei (AGNs), and in the presence of such a dense environment ($\sim 10^{14}\,\mathrm{cm}^{-3}$), they will form a new kind of stellar population denoted as Accretion-Modified Stars (AMSs). This hypothesis is supported by recent LIGO/Virgo detection of the mergers of very high-mass stellar binary black holes (BHs). We show that the AMSs will be trapped by the SMBH-disk within a typical AGN lifetime. In the context of SMBH-disks, the rates of Bondi accretion onto BHs are $\sim 10^9 L_{\rm Edd}/c^2$, where $L_{\rm Edd}$ is the Eddington luminosity and c is the speed of light. Outflows developed from the hyper-Eddington accretion strongly impact the Bondi sphere and induce episodic accretion. We show that the hyper-Eddington accretion will be halted after an accretion interval of $t_{\rm a} \sim 10^5 m_1\,\mathrm{s}$, where $m_1 = m_\bullet/10M_\odot$ is the BH mass. The kinetic energy of the outflows accumulated during $t_{\rm a}$ is equivalent to 10 supernovae driving an explosion of the Bondi sphere and developing blast waves. We demonstrate that a synchrotron flare from relativistic electrons accelerated by the blast waves peaks in the soft X-ray band ($\sim 0.1\,\mathrm{keV}$), significantly contributing to the radio, optical, UV, and soft X-ray emission of typical radio-quiet quasars. External inverse Compton scattering of the electrons peaks around 40 GeV and is detectable through *Fermi*-LAT. The flare, decaying with $t^{-6/5}$ with a few months, will appear as a slowly varying transient. The flares, occurring at a rate of a few per year in radio-quiet quasars, provide a new mechanism for explaining AGN variability.