J34a Very High Energy Pulsed Emission from the Crab Pulsar

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The Crab pulsar is one of the few pulsars that have been detected in almost all energies, ranging from radio to VHE gamma-rays. In the highest energy regime, the VERITAS and MAGIC experiments have recently detected pulsed signals between 25 GeV and 400 GeV. The light curves and the spectra obtained by these observations suggest that gamma-ray pulsars have high-altitude emission zones that avoid a super-exponential cutoff, which would be caused by magnetic pair production. Thus, outer-magnetospheric emission model, which assumes emission near the light cylinder and reproduces the wide-separated double-peak light curve, attracts attention. In this talk, I first solve the outer-magnetospheric emission zone from the basic equations (without assuming the location of the emission zone and the particle distribution functions) and demonstrate that the light curves and the phase-resolved spectra (up to 400 GeV) of the Crab pulsar can be quantitatively explained by the synchrotron-self-Compton emission from the cascaded pairs near the light cylinder. I also apply the same numerical code to various pulsar parameters and show that the gamma-ray luminosity is proportional to the square root of the spin-down luminosity, which is consistent with analytical examinations and with the observations.