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Optical Model for Large Area Photomultipliers of JUNO and Other

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Photomultipliers (PMTs) are widely used in scintillation and Cherenkov detectors for their great performances on photon detection. For example, the Jiangmen Underground Neutrino Observatory (JUNO) will use ˜18,000 20-inch PMTs in its central detector to achieve an unprecedented energy resolution of 3%/$\sqrt{}$(E(MeV)). A key parameter of PMT is its detection efficiency (DE), which will be strongly influenced by the optical processes in PMT including: (1) Reflection between external medium and PMT bulb. (2) Reflection, absorption and transmission on its anti-reflective coating and photocathode, in which interference effect happens. (3) Multiple reflection inside PMT. Based on multilayer thin film theory, experimental tests and Geant4 simulations, a PMT optical model has been established for the 20-inch PMTs used in JUNO, including the NNVT MCP-PMT and the Hamamatsu dynode PMT. In this talk, the PMT optical model and its related experimental tests will be introduced.

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Author: WANG , Yaoguang (Institute of High Energy Physics, CAS, Beijing, 10049, China)

Presenter: WANG , Yaoguang (Institute of High Energy Physics, CAS, Beijing, 10049, China)

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