

Progress of SPMT system in JUNO

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The JUNO (Jiangmen Underground Neutrino Observatory) detector was designed to achieve 3% energy resolution at 1 MeV, which required the installation of 17,612 high quantum efficiency 20-inch photomultiplier tubes (LPMTs) closely packed underwater around the liquid scintillator target ball. Additionally, 25,600 3-inch PMTs (SPMTs) were designed to be installed in the gaps of LPMTs to make a double calorimetry system that would improve and extend JUNO physics, such as improving energy resolution, muon reconstruction, supernova neutrino detection, and so on. The 26,000 3-inch PMTs have been produced and waterproof sealed. In particular, 16 SPMTs with similar gain were grouped together during waterproofing and will be supplied with the same high voltage. The readout electronics will also operate underwater, contained in 200 stainless steel boxes and the PMTs are attached to the electronics through 1,600 waterproofing multi-channel connectors. More than 600 SPMTs and 10 electronics underwater boxes have been installed in the 700-m underground JUNO detector, and commissioning will start soon. This talk will introduce the design and performances of the 3-inch PMTs and electronics and the recent installation status.

JUNO（江门中微子实验）探测器的设计目标是达到 3% @ 1MeV 的能量分辨率，这需要 17,612 个高量子效率的 20 英寸光电倍增管（LPMTs）在水下紧密围绕液体闪烁体。此外，还有 25,600 个 3 英寸 PMT（SPMT）安装在 LPMT 的空隙中，组成一个双量能器系统，以改进和扩展 JUNO 的物理目标，如提高能量分辨率、宇宙线 μ 介子重建、超新星中微子探测等。2.6 万支 3 英寸 PMT 已经全部生产完成并进行了防水密封。每 16 支增益接近的 PMT 分为一组并利用同一路高压供电。读出电子学装配在 200 个水下不锈钢桶中。PMT 和电子学通过 1,600 个防水插头连接。超过 600 支 SPMT 和 10 套电子学已经安装在地下 700 米的探测器上并即将开始联调。本报告将介绍 SPMT 系统设计和性能，并展示探测器最新安装进展。

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