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Development of multi-band receiving systems in the Nobeyama 45 m telescope and its perspective

This talk summarizes our progress of our HINOTORI (Hybrid Integration Project in Nobeyama, Triple-band Oriented) since 2016, which now enables us to simultaneously observe in 22/43/86-GHz bands in single-dish mode. The HINOTORI system just employs combination of perforated frequency-band selection filter plates installed in the quasi-optics of the Nobeyama 45 m radio telescope with the existing receivers. Some science cases have been published using this new system for monitoring circumstellar water and silicon monoxide maser sources. Efficient surveys of masers sources are further expected. There exist two issues in realizing VLBI application: the first the coexistence of the new VLBI backend system with the single-dish backend and the second the scheme of VLBI data calibration. It is necessary to develop good compatibility of the VLBI signal recording format with those in other VLBI stations, such as allocation of base-band channels. The scheme of instrumental delay calibration between the different frequency bands is also in an open question. This talk also introduces our new development of the ultra-wide band receiving system, NOCTURNE (Nobeyama Octatonic-scale bands, Unitary-frame Receivers Nexus) to cover a frequency range of 18—190 GHz (TBD). As its first step, an 18—58 GHz receiver in a room-temperature has been recently tested in Nobeyama as a water vapor/dry air radiometer but used for astronomical observations including VLBI. Thus the 45 m telescope is a great test bench for new receiver development at its lower cabin with easy access and installation environment.

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