Instrumentation development for the 2020 decade at the NOEMA and 30m telescopes

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IRAM operates several millimeter telescopes from two sites. The NOEMA interferometer, observing from 70-370 GHz and located in the French Alps, saw the completion of its 10th 15m antenna in September 2018 and two more antennas will be added to the array in the coming years. The 30m telescope observes in the same frequency range and is located on the Pico Veleta (3000m), Spain.

This talk will present the current instrumentation status and the plans for the near and far future. The current generation NOEMA receivers were well detailed in [1]. Without waiting for the completion of the NOEMA array, the next upgrades and projects are already moving forward and will be discussed here in detail.

Currently, 4 bands are available, 70-116 GHz, 127-180GHz, 200-276 GHz and 275-373 GHz, with dual polarization side band separation mixers having 4-12 GHz IF bandwidth for the first 3 bands and 4-8 GHz for the last band. The next step for this NOEMA receiver upgrade is to allow dual-band operation using dichroic filters for frequency separation [2], which will allow performing interferometric observations at two RF frequencies simultaneously.

On the detector side, new generation of SIS mixers are being developed, on silicon-on-insulator (SOI) substrates, with the goal of achieving extended RF and IF bandwidths.

At the same time, to allow for more efficient observations, several atmospheric monitoring projects are ongoing. A prototype of a new generation of water vapour radiometer at 22 GHz is being finalized. Those will ultimately equip all NOEMA antennas, and their improved measurement of the water line profile is used real-time to correct and improve the phase noise for each antenna. Another atmospheric monitoring project initiated and implemented with the help of the SMA observatory, is the phase-monitoring project where 2 or more satellite commercial dishes are equipped with commercial X band LNB and interferometric measurement allow retrieving the atmospheric phase variations (detail presentation in [3], this conference).

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Fig. 1. View of the Plateau de Bure, in the French Alps, where 10 15m antennas are now operational, for the NOEMA interferometer. Two more antennas are currently under construction to be installed in the next few years.

At the 30m telescope in Spain, the NIKA2 dual-band millimeter array camera started operations a few years ago [4]. It has an instantaneous field-of-view of 6.5 arcminutes at both 1.2 and 2.0 mm with polarimetric capabilities at 1.2 mm. The 3 detector arrays are made of more than 1000 KIDs each. Recently, at the end of 2018, the polarimetric capabilities were successfully commissioned. IRAM also started the development of very large 50 pixel- 3mm and 98 pixel- 1mm multibeam receivers based on SIS mixers, which will replace the HERA 2x9 multi pixel 230 GHz array and complement the EMIR heterodyne receiver [5] spectroscopic capabilities allowing for large scale mm-wave mapping of extended objects.

References

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