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Status and prospects of the KAGRA detector characterization

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The KAGRA gravitational-wave detector is rapidly being commissioned and integrated towards the joint observation run with LIGO and VIRGO.

The laser-interferometer type of the gravitational-wave detectors are based on very complicated optical systems, with numerous feedback control loops at an extreme high precision. Since the interferometer is so complex, there are many possible states of the operation, such as operating stably with low noise, operating with noises whose sources are identified, operating with noises whose sources are unknown, and not operating. Furthermore, the interferometer is affected by the environmental perturbations such as earthquakes and tidal waves of the ocean, through various noise coupling mechanisms.

The goal of the detector characterization team (Detchar) is to understand the behavior of the interferometer, the states of the environment, and various noise coupling mechanisms. The study includes the software developments as well as instrumental experiments. The obtained insights of the interferometer are crucial from the following three aspects:
(i) Data analysis. For when the gravitational-wave channel is analyzed for the event search, Detchar provides the state information of the interferometer which are based on the study of the interferometer behavior. Gravitational-wave channel data is avoided when the interferometer was operating in a bad state so that the efficient searches can be performed and so to avoid false alerts of the gravitational-wave events.
(ii) Instruments. By studying the noise sources and their coupling routes, some of them are identified. When possible, those noises will be mitigated and the interferometer performance will be improved.
(iii) Commissioners. Detchar provides software tools to present the status of the interferometer and environmental information. With such tools, specific plots of the instruments and Detchar results are easily accessible for the commissioners (and anyone in the collaboration) so the noise hunting will be done quicker and more efficiently.

Thus, detector characterization team will serve as a "brigade" between the instruments and data analysis studies. In this talk, the prospects of the KAGRA detector characterization towards O3, and the current status are presented.

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