

Lectures on Cosmology with Planck at IPMU

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“Lectures on Cosmology with Planck at IPMU”^{*} was quite a stormy seminar due to Typhoon No. 10. The seminar was held from August 29 to 31 at the Kavli IPMU, but the schedule for August 30 and 31 was postponed in order to avoid the typhoon and any other accidents. Therefore, supplementary lectures were held on September 13 on the University of Tokyo’s Asano campus. The lecturer was Dr. Guillaume Patanchon (University Paris Diderot) who is working on the Planck experiment: a cosmic microwave background (CMB) observation with a satellite which was launched in 2009 by the European Space Agency.

The main target in the audience was young post-docs and students who are not yet particularly familiar with cosmology, and many attendees came from KEK (Sokendai), JAXA, NAOJ, Yokohama National University, and Okayama University, in addition to the University of Tokyo. It shows a high level of interest in the recent

results of the Planck experiment.

The lecture started with general relativity and an introduction to cosmology. Basic parameters in the standard model of cosmology were also introduced. The expansion of a homogeneous and isotropic universe was explained by calculating the FLRW (Friedmann-Lemaître-Robertson-Walker) metric. On the second day, perturbation in the universe was discussed. Calculation of the anisotropy was carefully performed, as anisotropy of the CMB photon temperature is one of the most important topics. The relation between the CMB power spectrum and cosmological parameters was explained for beginners. Lectures then moved into observation of the CMB. The design of the Planck satellite, high-frequency and low-frequency instruments, cooling system, and bolometer sensor of the detectors were shown. At the end, results from the recent Planck experiment (published in 2015) were

presented. The observed CMB maps and spectra, as well as the fitted cosmological parameters, were shown in comparison with other experiments. The results with respect to B-mode polarization were presented with a comparison to a recent BICEP2 experiment. A measurement of non-Gaussianity was also mentioned.

On the additional day, the analysis method and systematic uncertainties were discussed. Issues such as long time-constant signal by cosmic rays, noise from 4K coolers, and non-linearity of ADC were realistically discussed, thanks to the lecturer’s experience in analyzing the Planck data.

Finally, a Q&A session of the lessons of the Planck experiment was held, and meaningful information was exchanged by CMB experimentalists. The seminar finished on a high note.

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