



Spectral Fidelity

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Organisers:

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Abstract. This is a very exciting time for the spectroscopic community. So much exquisite data are available in several fields, such as exoplanets, stars, galaxies and quasars, thanks to high-resolution, high-precision and accuracy spectrographs. It is time to discuss spectral fidelity and what we can expect from the future.

Keywords: spectroscopy, high resolution, accuracy, precision, instrumentation.

Topics covered: Exoplanets & atmospheres, Stellar Physics, Stellar Abundances, HARPS & ESPRESSO, Fundamental Physics, ISM & IGM, Cosmology, Massive Surveys and Fidelity, Calibration, Data Reduction, Data Analysis, Instrumental requirements for Fidelity, Ancillary developments (simulations, models, laboratory, etc.), High spectral fidelity @ ELTs, Legacy of spectral fidelity.

Summary of the Conference

Spectroscopy is one of the main tools for peering into the physics of the Universe. The installation of HARPS at the 3.6m telescope of ESO in La Silla 20 years ago opened the way for the study of extrasolar planets. Innovative ways to use HARPS have been developed in the last two decades, along with other instrument capabilities, such as high accuracy, high precision and stability, beyond the search for exoplanets; this research is rapidly expanding to the IR domain. As a result of these efforts, it has been possible to deeply investigate different scientific areas, from the stars in the Milky Way to far galaxies and quasars, also exploiting the huge amount of information provided by spectroscopic surveys and archival data.

Taking advantage of the extensive heritage of HARPS, of the first five years of operations of ESPRESSO on the ESO VLT, of the new results from near-infrared spectrographs, planning for ANDES and the ELTs, several aspects of spectral fidelity, like Doppler shifts precision and accuracy, were thought to be timely and



Figure 1. Prof. Michel Mayor receives the “Chiavi della Città” of Florence from the city’s mayor, Dario Nardella.

were addressed at the meeting. Attention was also paid to how well spectra are characterized in terms of noise, scattered light, detector effects and instrumental profile; the nature of realistic elemental abundance uncertainties; whether the current precision is enough or further accuracy is required; the of limits of precise and accurate spectroscopy and the exciting science that will be enabled by new performances; the science that requires spectral fidelity and how we can enable it.

Almost 100 experts (both scientists and technologists) from different areas attended the conference. Many PhD students and young researchers were present and presented their results, as well as senior researchers. The program had been prepared mixing different topics, from exoplanets to stars, stellar abundances, intergalactic medium, quasars, data reduction techniques and tools, calibration and data treatment, with the aim of encouraging the discussion. The final round table underlined the lessons learned so far in spectral fidelity and opened up new questions on what we can expect from the data provided by future instrumentation.

The website of the meeting, including all the presentations, is available at this link: <https://www.eso.org/sci/meetings/2023/fidelity.html>

External activities related to the Conference

In 1995, during a Conference in Florence, Prof. Michel Mayor announced the discovery of the first exoplanet orbiting a star similar to our Sun. For this

revolutionary result and his work in the field, he received the Nobel Prize in Physics in 2019, together with Didier Queloz. To celebrate this link between the city of Florence and the announcement of the first exoplanet, Prof. Mayor, who attended as invited speaker on “Spectral Fidelity”, received the “Chiavi della Città” of Florence from the city’s mayor, Dario Nardella, at a ceremony held at Palazzo Vecchio on September 6th. He also gave a public lecture at Teatro del Cielo of the Osservatorio di Arcetri on September 7th, as part of the “Notti di Arcetri” festival.