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The terrestrial radiation belts as seen by BepiColombo during its flyby to Earth

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BepiColombo is a joint mission of the European Space Agency (ESA) and the Japan Aerospace Exploration Agency (JAXA) to the planet Mercury, that was launched in October 2018 and it is due to arrive at Mercury in late 2025. It consists of two spacecraft, the Mercury Planetary Orbiter (MPO) built by ESA, and the Mercury Magnetospheric Orbiter (MMO) built by JAXA, as well as a Mercury Transfer Module (MTM) for propulsion built by ESA. The cruise phase to Mercury will last ~7 years and constitutes an exceptional opportunity for studying the evolution of the solar wind, solar transients, as well as for planetary science and planetary space weather. Some important aspects to consider during the cruise are the close distances to the Sun that BepiColombo will face, the near half-solar activity cycle that will cover, as well as the several flybys to Earth, Venus and Mercury that will perform. So far, BepiColombo has accomplished a flyby to Earth in April 2020 and a flyby to Venus in October 2020, with a second flyby to Venus programmed for August 2021 and the first Mercury flyby in October 2021.

This work focuses on the flyby to Earth, and in particular, on the radiation belt observations performed by several instruments onboard BepiColombo. The flyby occurred on 10 April 2020 under relatively steady solar wind conditions. BepiColombo crossed the outer radiation belt on the terrestrial dawn side when moving from the day side to the night side. It skimmed the inner radiation belt on the night side sector after dawn, and then crossed again the outer belt at night (behind the dusk terminator region). Two instruments onboard the MPO spacecraft were able to take measurements of the belts: the BepiColombo Radiation Monitor (BERM) and the Solar Intensity X-

Ray and Particle Spectrometer (SIXS). In this work, we report the particle species, radiation and energies observed by these two instruments, as well as we perform a cross-calibration of their detections, which is an important activity in preparation for joint-observations of the Hermean environment. Moreover, using magnetic field observations from MPO-MAG, we also investigate the trajectory of the particles within the radiation belts. This work is complemented with data from other missions that give us the state of the terrestrial system and frame our observations into the right context. It includes data from Cluster-II, Themis, and Arase/ERG missions.