Can high energy particle detectors be used for improving risk models in space radiobiology?

(A.Bartoloni[1], S.Strolin[2] ,L.Strigari[2])

[1]INFN Roma and CERN
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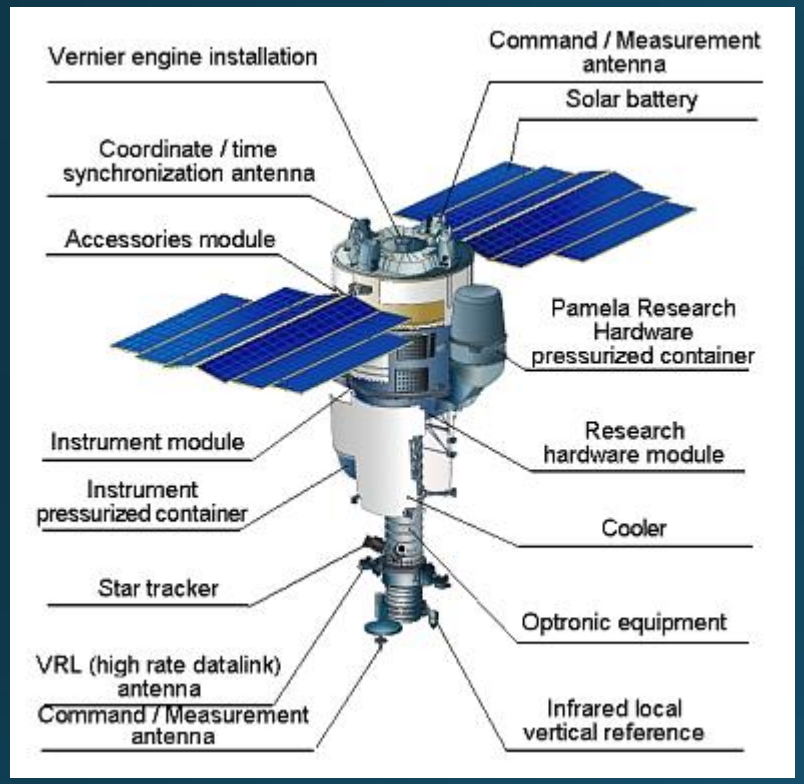
Detectors to measures Cosmic rays Properties

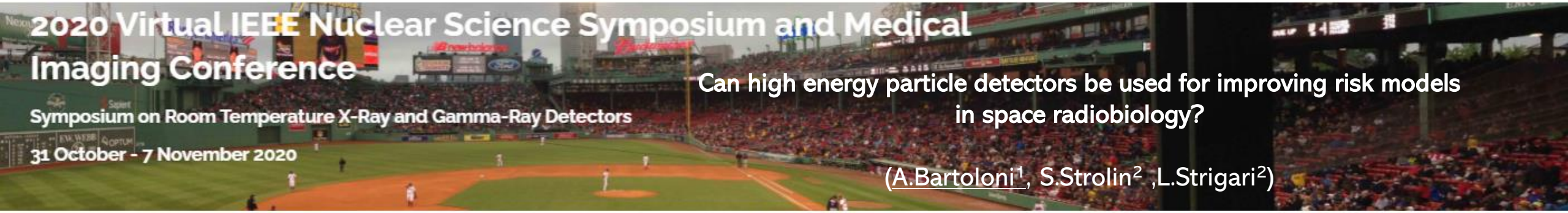


In the last two decades many experiment was built and deployed in space to produce a complete inventory of charged particles and nuclei in cosmic-ray (CR). The physics goals are the study of CR properties, indirect search of Dark Matter and direct search of primordial antimatter

By now precise measurements of CR components exist in the energy region from few KeV to hundreds of TeV.

AMS in Figures

- **7.5 t** Weight
- **5×4×3 m³** Size
- **0.14 T** Magnetic Field Intensity
- **16/05/2011 08:56 AM EDT** Launched



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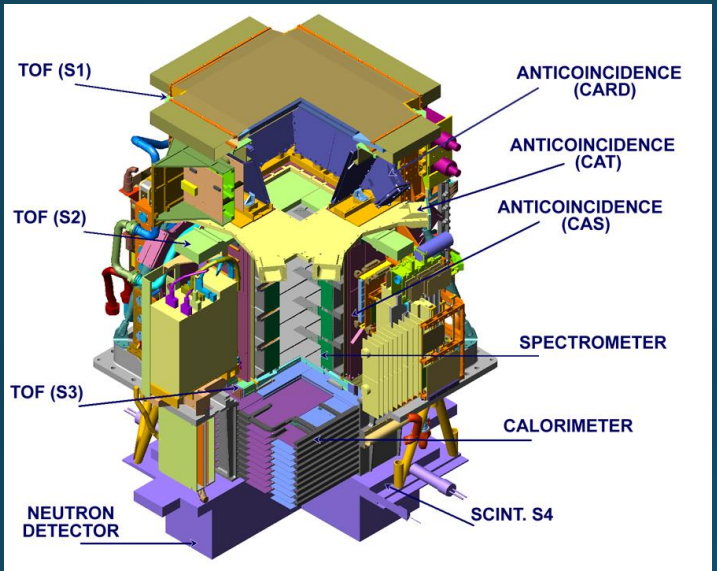
Pamela Experiment (2006-2016)

Picture of PAMELA after assembly

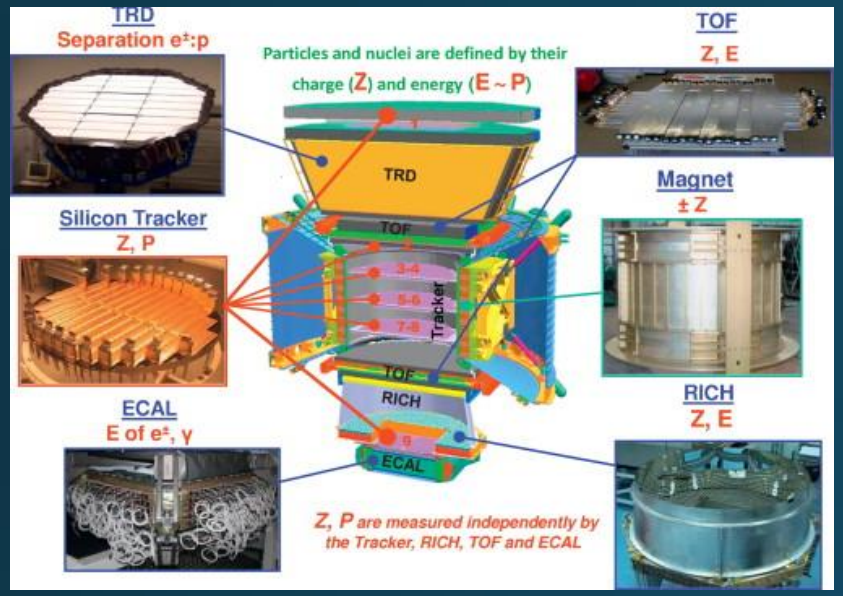


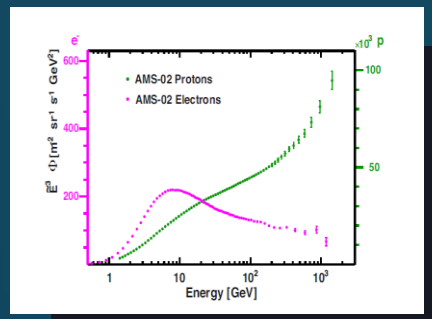
Pamela Capability	
Particle	Energy Range
Antiproton flux	80 MeV – 190 GeV
Positron flux	50 MeV – 270 GeV
Electron flux	up to 400 GeV
Proton flux	up to 700 GeV
Electron/positron flux	up to 2 TeV
Light nuclei (up to Z=6)	up to 200 GeV/n
Light isotopes (D, 3He)	up to 1 GeV/n

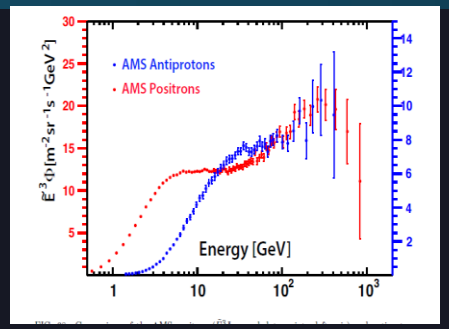
PAMELA (Payload for Antimatter Matter Exploration and Light-nuclei Astrophysics) launched in June 2006 , attached to the Russioan RESURS-DK1, took data for ten years until 2016.

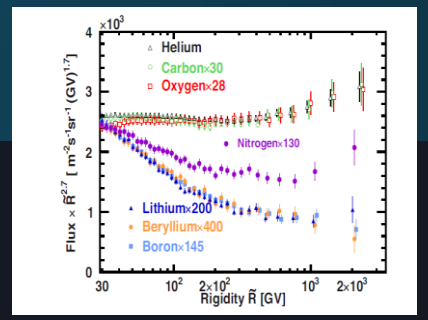
Its sensitivity gave the possibility to measure particles and nuclei up to Z=6 in the energy range up to hundreds of Giga ElectronVolts

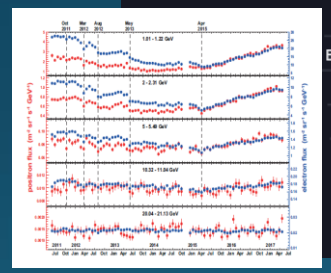
AMS02 (2011-present)

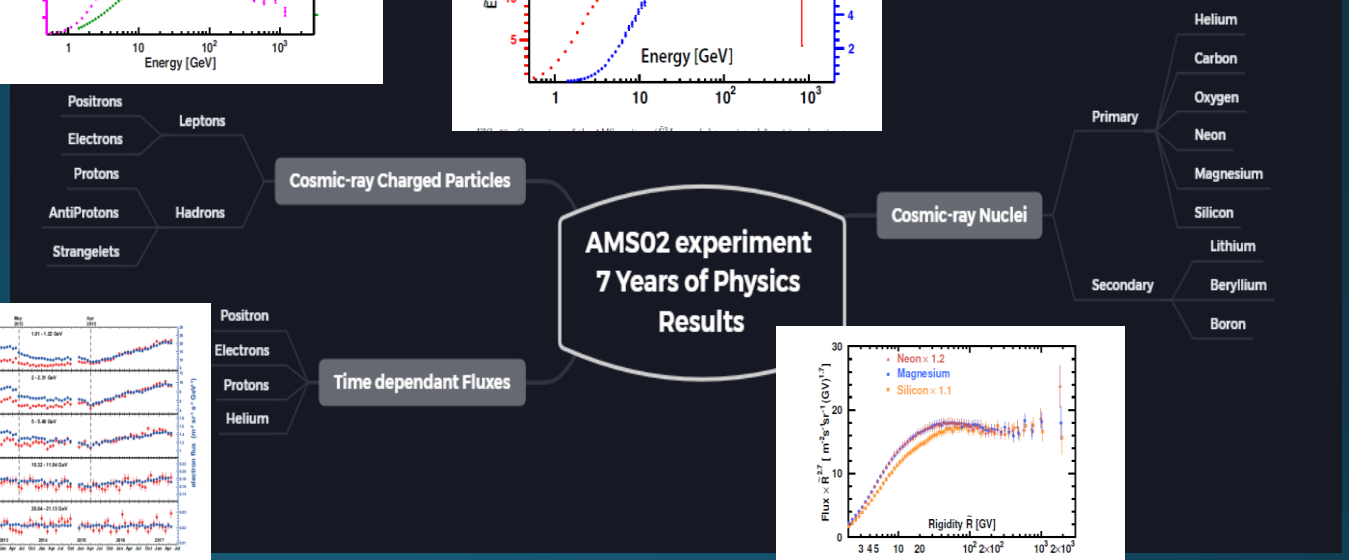






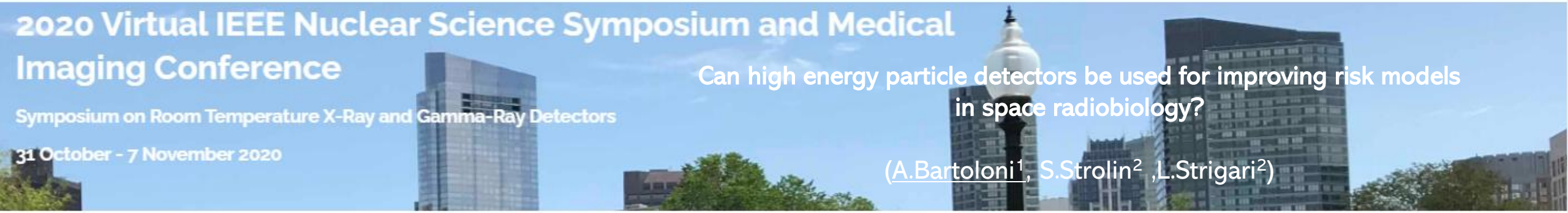






AMS02 (Alpha Magnetic Spectrometer) is installed from May 2011 on the International Space station and will continue to operate throughout the lifetime of the ISS (2028)

In the last years the AMS collected more than 166 billions cosmic rays events and the AMS collaboration produced new measurements of unprecedented precision of charged particle fluxes that compose the Cosmic rays up to high Z nuclei



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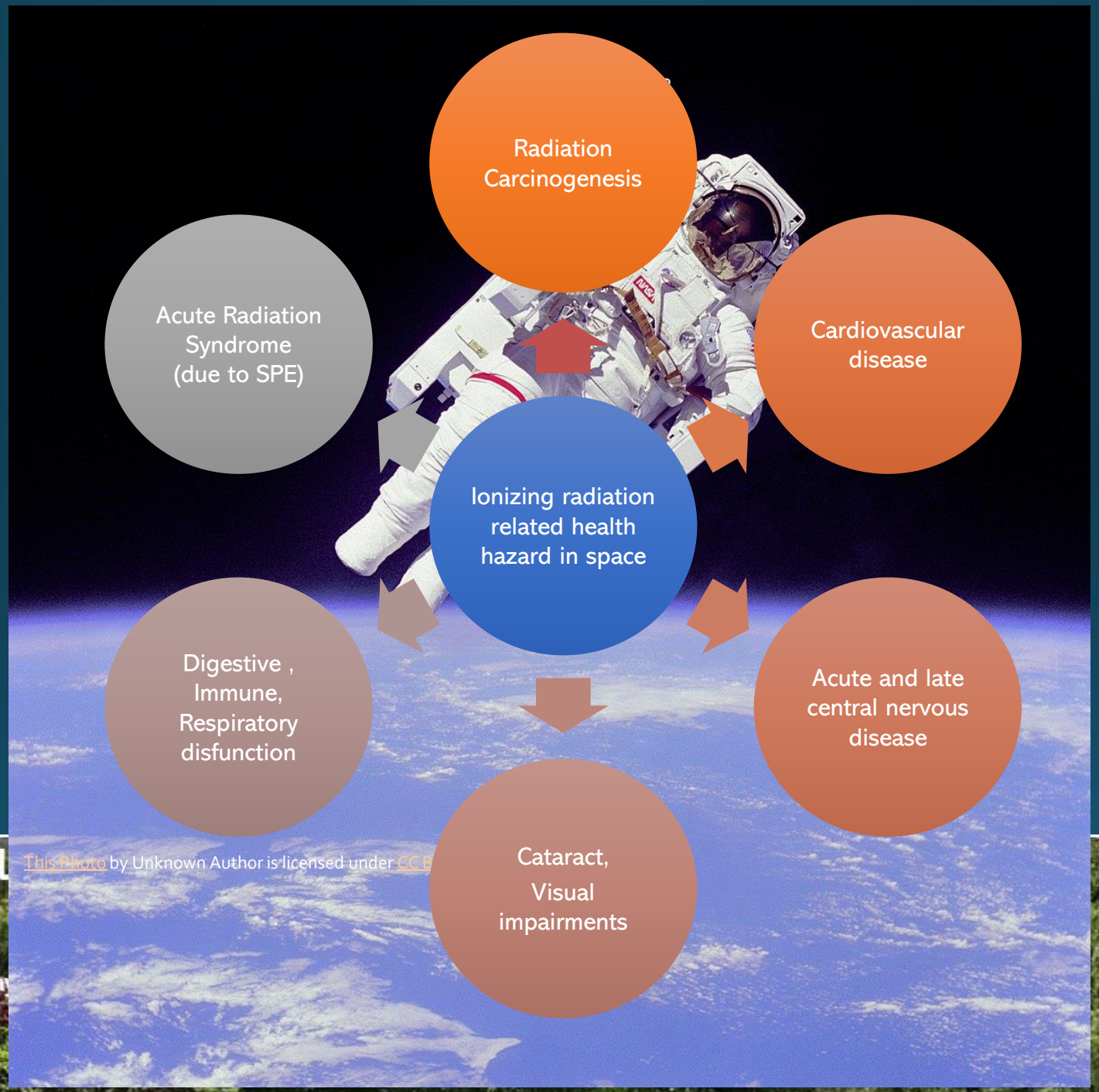
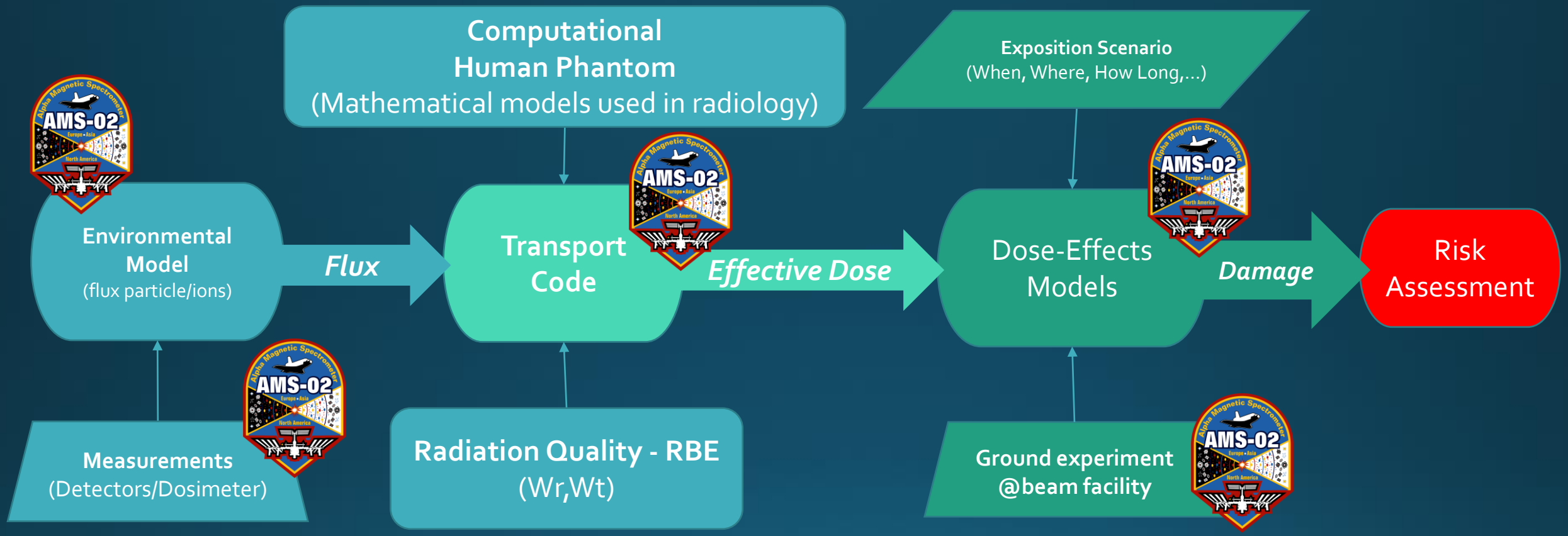
Ionizing radiation exposures is one of the main concern for astronaut's health involved in exploratory missions to the Moon and Mars due to the high doses of radiation expected during the flight and on the surface

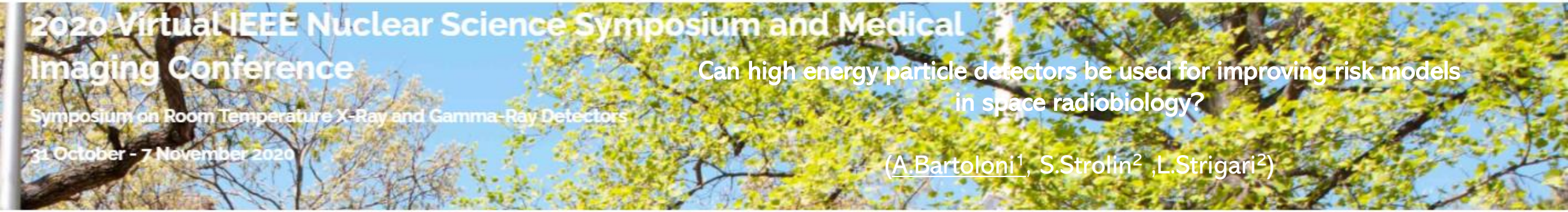


The radiation health hazard assessments in exploratory space missions requires the evaluation of the dose effects models in order to quantify the expected damage in the forecast astronaut's exposition scenario.

To complete this task the charged particle data taken by the high energy particle experiments can be useful to increase knowledge in many part of the risk assessment phases

Radiation health hazard assessment in exploratory space missions





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SPRB Collaboration

To address such problems a research collaboration on SPace RadioBiology (SPRB) is active since the 2017 between the INFN Roma-Sapienza AMS group and the Medical Physiscs Department of Policlinico S.Orsola in Bologna (Italy)

The aim is to address the topic of space radiobiology by the comparison of possible effects on the health of astronauts from particles and dangerous charged nuclei with the radiobiology experience in the clinical field where the ionizing radiations are used for therapy and diagnosis

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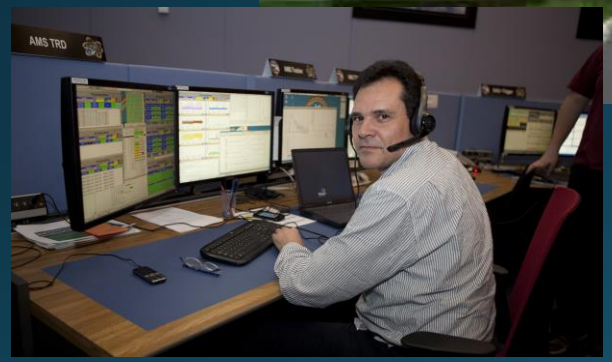

If you are interested to collaborate on the SPRB with our research group please contact

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