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Investigation of extensive air shower properties with the CODALEMA experiment : tackling the challenges of the next generation cosmic ray observatory.

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Our knowledge on ultra-high energy cosmic rays and their underlying sources and acceleration mechanisms is steadily improving thanks to the large observatories nowadays in operation. However the need for a next generation instrument is emerging from their experimental limitations and the scientific questions currently out of reach within a reasonable time line. Within these scope, the main features of the radio detection of extensive air showers will be investigated and confronted to these challenging requirements. CODALEMA is the last experiment currently running in Europe dedicated to the cosmic ray detection using the observation of its induced radio electric field. The latest experimental upgrade will be presented and the main results of CODALEMA will be summarized. A special emphasis will be put on the detailed and precise access to the air shower features and the cosmic ray properties given by the radio detection technique and its unique capabilities with respect to the usual cosmic ray detection methods. The opportunities provided by the Nançay observatory for efficient R&D activities and for fast prototyping of new emerging detection methods will be also presented. Examples of such experimental developments will be given.

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