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Calculating the Mass of the Axion

Researchers at JSC – Zoltan Fodor, Taichi Kawanai, Simon Mages, and Kalman Szabo – together with colleagues from Wuppertal, Budapest, and Hamburg calculated the mass of the axion, with the result recently published in *Nature* (see DOI:10.1038/nature20115).

The axion is a hypothetical elementary particle, which is believed to be the key to solving two major puzzles in fundamental physics. The first is the pressing question of why the strong interaction is surprisingly symmetric under the transformation which exchanges left with right. Axions can solve this problem by cancelling the possible symmetry violating parts of the strong interaction. The second long-standing puzzle is that of dark matter: according to current astrophysical and cosmological observations only 15 % of our Universe is visible and the rest is dark, which means that they have practically no interaction with known particles such as photons. Axions are viewed as being a natural candidate for the particles out of which dark matter is made. The theory behind this predicts a tiny but non-zero coupling to photons, which can be used to detect them in laboratory experiments. For several years now, many experiments have attempted to find such particles – but so far without success. The difficulty in these experimental searches is that the mass of the axion is not known beforehand, a parameter on which the design of the experimental apparatus crucially depends.

The researchers have succeeded in deriving a mass range for the axion based on the assumption that these particles constitute dark matter. For this calculation, the details of the strong interaction had to be accurately modelled, for which the supercomputing resources of JUQUEEN were inevitably required. The result is an important contribution to the experimental search for these particles. The *Nature* Editorial Board has chosen to highlight the result in its News&Views section (see DOI:10.1038/539040a).

(Contact: Prof. Kalman Szabo, *k.szabo@fz-juelich.de*)

EasyBuild User Meeting at JSC

From 8 to 10 February 2017, JSC will host the 2nd EasyBuild User Meeting. EasyBuild is a software build and installation framework that enables the management of software on high-performance computing systems in an efficient way. It is the tool that has been used in production at JSC to deliver the software stack and environment since the deployment of JURECA, and previously in the test system JUROPA3. With EasyBuild, JSC is able to provide – in a way that is reproducible and easy to understand – a complex software infrastructure that requires multiple combinations of GCC, Intel, and PGI compilers as well as ParaStationMPI, Intel MPI, and MVAPICH as MPI runtimes. In total, JSC provides 800 unique and up-to-date software packages every six months, but this combinatorial explosion of packages is still presented in an easily understandable hierarchical structure.

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Despite being production-ready since 2012, EasyBuild has been comprehensively extended, updated, and improved in the last two years, and is today a very active project in github, with close to 100 contributors from all over the world. Of those, JSC stands out as a key contributor with a number of important improvements since EasyBuild was adopted to manage the software stack in JSC's clusters.

This user meeting follows the trend initiated last year by the main developers of EasyBuild: the HPC group at Ghent University. There will be presentations from various sites explaining their own setups, as well as presentations about how EasyBuild relates to various tools and technologies, such as Lmod and containers in an HPC environment. The user meeting will also adopt a hands-on approach with a tutorial taking place and attendees working together to implement new features. More details can be found at *http://www.fz-juelich.de/ias/jsc/eum17*.
(Contact: Dr. Damian Alvarez, *d.alvarez@fz-juelich.de*)

Second NIC Excellence Project 2016

Twice a year, the NIC Peer Review Board honours outstanding simulation projects with the NIC Excellence Project award. We are pleased to announce that the latest award is being given to Dr. Karl Jansen (Deutsches Elektronen-Synchroton – DESY Zeuthen) for his project "Hadronic contributions to electroweak observables". The project is concerned with deviations from the classical value of the magnetic moment of the spin 1/2 muon, a lepton which is very similar to the electron but about 200 times heavier. It is the second project to have received the award this year. For more details and previous award winners, see *http://www.john-von-neumann-institut.de/nic/excellence-2016*.
(Contact: Dr. Alexander Schnurpfeil,
coordination-office@fz-juelich.de)

Julia Valder – Best MATSE of NRW and Germany

For her outstanding results in the final examinations of the MATSE (mathematical-technical software developer) training course, Julia Valder from JSC has been awarded as the best MATSE trainee in North-Rhine Westphalia (NRW) as well as throughout Germany in 2016. On 4 November, she was honoured at a large ceremony in Düsseldorf organized by the regional associations of the German Chambers of Industry and Commerce (IHK) in NRW, emphasizing the excellent achievements of 265 trainees in all professions. The graduates were rewarded with a speech by Garrelt Duin, Minister for Economic Affairs in NRW, and live music from Clueso.

As she was also the best MATSE graduate in Germany, Julia Valder received an additional award on 5 December in Berlin. The ceremony for the best trainees of all German vocational training courses included a speech by Federal Minister for Family Affairs Manuela Schwesig. Impressions of the event are available at *https://dihk.imageplant.de/bestenehrung*.
JSC congratulates Julia Valder on this great success!

Along with her MATSE degree, Valder graduated with a bachelor's degree in Scientific Programming by completing her thesis on a Multiuser Platform for Virtual Experiments in Pedestrian Dynamics. Julia Valder continues to work at JSC while also undertaking a master's degree in Technomathematics.
(Contact: Carsten Karbach, *c.karbach@fz-juelich.de*)

Awards for Bachelor's and Master's Students

On 9 December 2016, six students from Forschungszentrum Jülich were awarded the medal of honour (Ehrenplakette) from Aachen University of Applied Sciences (FH Aachen). In a ceremony at Aachen's historic town hall, Prof. Baumann, rector of FH Aachen, honoured Niklas Adams (IEK-3), Felix Kibellus (IKP-1), David Südholt (IEK-5), and Julia Valder (JSC) as the best graduates of the bachelor's course Scientific Programming, while Jette Schumann (IKP-1) and Patrick Embgenbroich (IBG-2) were awarded as the best graduates of the master's course Technomathematics.
(Contact: Prof. Johannes Grotendorst,
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JSC News via E-Mail

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Events

JUQUEEN Extreme Scaling Workshop 2017
Instructors: JSC staff members
Date: 23–25 January 2017, 09:00–16:30
Venue: Jülich Supercomputing Centre, Ausbildungsraum 1
Info: *http://www.fz-juelich.de/ias/jsc/events/ext-scale-2017*

Introduction to parallel programming with MPI and OpenMP
Instructor: Benedikt Steinbusch, JSC
Date: 31 January – 3 February 2017, 09:00–16:30
Venue: Jülich Supercomputing Centre, Ausbildungsraum 2
Info: *http://www.fz-juelich.de/ias/jsc/events/mpi-intro*

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