

## CALL FOR PAPERS

*IEEE Journal on Exploratory Solid-State Computational Devices and Circuits*

**Special Topic on Emerging Hardware for Cognitive Computing**

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### Aims and Scope

Emerging materials and physics can be leveraged for new device-inherent behavior that can have system-level benefits. Motivation for device, circuit, and system behavior can be drawn from how the human brain processes certain data-intensive tasks adaptively and quickly, such as canonical image recognition. The field of neuromorphic computing has made great strides in implementing multi-weight synaptic behavior, as well as neuronal behavior such as integrate-and-fire and stochastic switching, and implementation of such behaviors in deep neural network (DNN) processing. Using CMOS, emerging resistive memories, and other device types as the basis, neuromorphic computing is innovating vertically from devices, to circuits, to systems to re-define how computation can be done. Looking forward, the realm of “cognitive computing” is inspired by new and continually emerging understanding of advanced brain and neuronal behavior that enables efficient and real-time learning and reaction.

This call for papers is on emerging hardware for cognitive computing. The focus and emphasis of these special topic papers is beyond DNN processing, as well as beyond multi-weight synapses and basic neuron integrating, firing, and stochasticity. Some example topics of interest include coherent reaction to multiple stimuli and input frequencies, hierarchical temporal memories, coupled dynamics between multiple stimuli and between devices or systems, both short-range and long-range connectivity in the devices and circuits, real-time adaptation to the data the computing system is processing, reconfigurability based on inputs, approximate computing that uses sparsity, and many other bio-inspired behaviors. Papers are encouraged that address implementation of advanced cognitive features at all levels (materials, device, circuits, and systems), including showing at a system level how such advanced functions can be useful for computing tasks and understanding the system-level energy efficiency and speed.

### Topics of Interest

- Reconfigurable and tunable materials and their application to computing
- Emerging resistive memories (e.g. MRAM, RRAM, PCM, FeFETs, etc) and taking advantage of their unique physical properties and how those properties can be mapped onto cognitive features

- Emerging materials and devices such as low dimensional, spintronic, ionic, and others that can be used for cognitive computing
- Circuits that make use of new device features or on their own have cognitive computing features such as long-range connectivity
- System-level and algorithm application of the devices and circuits and their benchmarking, e.g. Bayesian confidence propagation neural networks
- System-circuit-device co-design for cognitive computing
- Prototypes, simulation, and theory all welcome

### **Important Dates**

Open for Submission: April 15<sup>th</sup>, 2021

Submission Deadline: July 15<sup>th</sup>, 2021

First Notification: Aug 15<sup>th</sup>, 2021

Revision Submission: Aug 31<sup>st</sup>, 2021

Final Decision: Sept 15<sup>th</sup>, 2021

Publication Online: Sept 30<sup>th</sup>, 2021

### **Submission Guidelines**

**[The IEEE Journal on Exploratory Solid-State Computational Devices and Circuits \(JXCDC\) IS AN OPEN ACCESS ONLY](#)**

**PUBLICATION:** Charge for Authors: \$1,350 USD per paper. Paper submissions must be done through the ScholarOne Manuscripts website: <https://mc.manuscriptcentral.com/jxcdc>

Guidelines for papers and supplementary materials, as well as a paper template, are provided at this website (also on the next page).

Inquiries for the JxCDC Journal should be sent to: [JXCDC@IEEE.ORG](mailto:JXCDC@IEEE.ORG)

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Electron Devices Society

### **PAPER FORMAT DESCRIPTION:**

Papers can have 2 parts – the first part is a 4-8 page main paper (following a strict format – template available from website), and the second part is the supplementary material. The main paper itself will just focus on describing why the work is important, the state of the prior art, the key new accomplishment(s) or results, and then what the research directions are going forward. The main paper can have an accompanying supplementary material (detailed methods) part. The supplementary material is not mandatory, but authors are strongly encouraged to submit supplementary material, which will increase the chance of acceptance. The Supplementary material (detailed methods) will be peer reviewed along with the main paper.

**Style guidelines for the main paper:**

The main report (min. of 4, max. of 8) is written in format of a letter. Due to their letter nature, the research must be original and must be of interest to research scientists/engineers and industry in related fields.

*Abstract guidelines:* The report begins with a fully referenced paragraph, ideally 200 words aimed at readers in the general area of engineering and physical sciences. The references must be up-to-date (e.g. referring to the best available materials, devices, circuits) & convey the relevance and originality of the research. This paragraph starts with a 3-4 sentence basic introduction to the problem area explaining the relevance and the issues. This is followed by a one-sentence statement of the main conclusions (e.g. 'Here we show' or equivalent phrase); and finally, 2-3 sentences putting the main findings into general context so it is clear how the results described in the paper have moved the field forwards.

*Body:* The text of the article must be succinct and start with general audience and progressively increase the complexity for experts. The body of the main paper must provide clear context to the present work based on established industry roadmaps, figures of merit or generally accredited framework (computational throughputs, leakage power, long form Reviews of Modern physics, IEEE proceedings, Nobel lectures). To enable the comparison it is encouraged that key quantitative findings of the paper are compared in a table with current references. Any concluding statements at the end of the article must be short since key conclusion is clearly articulated at the introduction. A repetition of the conclusions in the abstract should be avoided. Concluding statements explaining future possibilities or evolution are encouraged.

**Style guidelines for supplementary material (methods paper):**

The supplementary material is a unique format to encourage complete and clear communication of the relevant information to the experts in the area, while providing a citable source for the students for the innovations in scientific method: processing, modeling and theory. Long form derivations and code submissions are encouraged for theoretical and modeling papers. Modeling papers could for example provide all relevant data (not necessarily the code but they could) required to reproduce or validate the results. The JxCDC encourages the authors to put the experimental details such as fabrication methods, detailed characterizations, models or simulation methods (if it is a theory paper). The supplementary information therefore documents innovations in the experimental and modeling scientific methods, e.g. an innovative process technique to avoid interface effects, newly adopted differential equation solvers or innovative developments in device/circuit analysis can be included (and students/researchers will have a citable source online). Background materials that help the reader can be referenced in the supplemental material.

The supplementary material part begins with an unreferenced abstract (typically 150 words) and is divided into separate sections for introduction, results, discussion and methods. Introduction and discussion are brief and focused. The results section usually contains a general description followed by their validation. The methods section provides technical details necessary for the independent validation of the methodology, without referring to a chain of bibliographical references. The text of the supplementary material (excluding abstract, methods, references and figure legends) is limited to 6000 – 7000 words. Articles have no more than 12 display items (figures and tables). The results and methods should be divided by topical subheadings; the

discussion may contain subheadings at the author's discretion. If statistical testing was used to analyze the data, the methods section can contain a subsection on statistical analysis. If significant EDA tools are employed, relevant validation can be provided for the novel approach. The experimental tools and the instrumentation used must be explained in a clear schematic preferably with the models (part numbers) mentioned.

In summary, all the new contributions and accomplishments are to be summarized in the 4 to 8 page main paper. The main paper format will be such that it can be understood by not only the expert but also the non-expert (providing the context to someone unfamiliar but wanting to follow progress in the field). All experimental or simulation methods to enable reproducing/validating the results of the paper are in the supplementary material (detailed methods) part.