

Elements

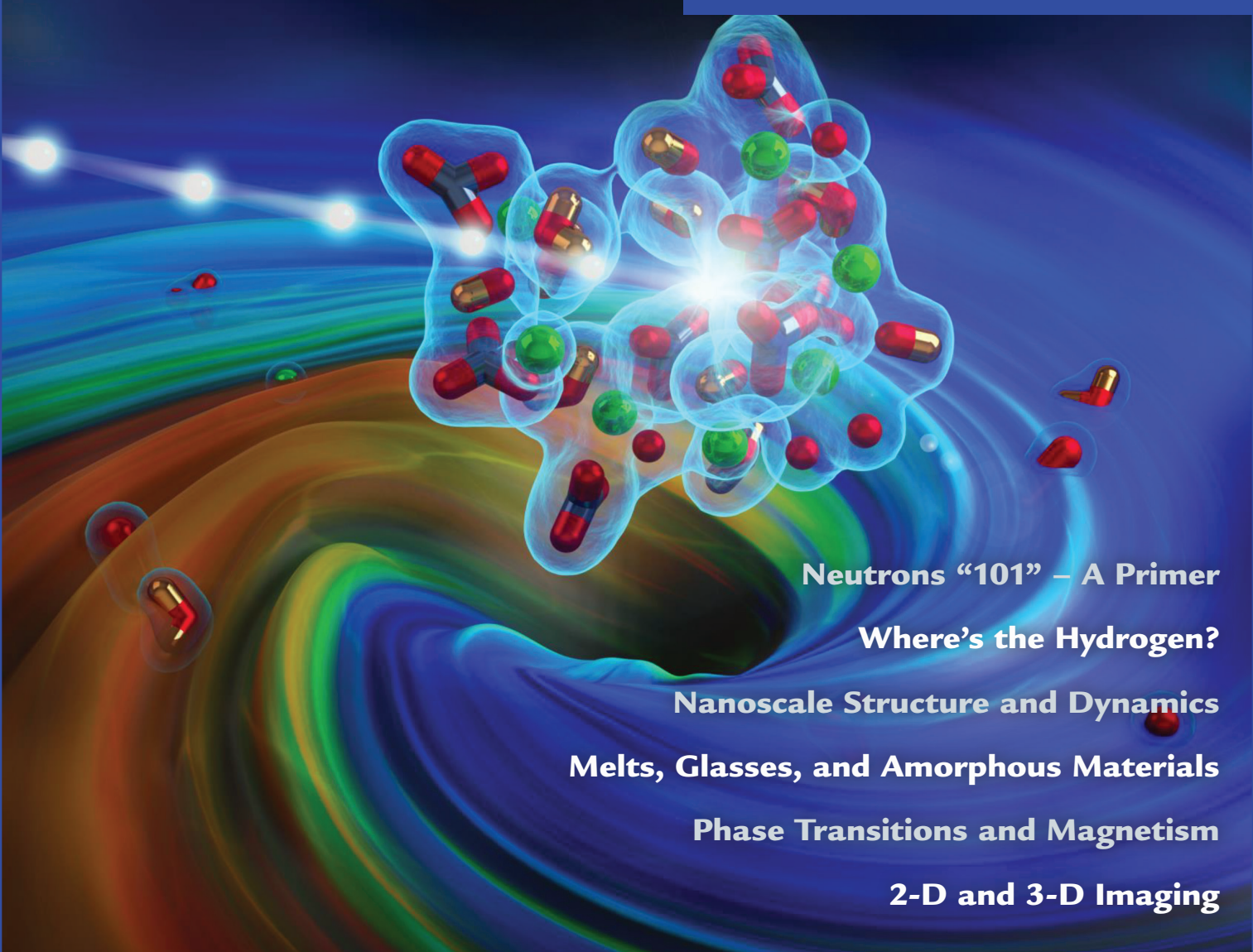
An International Magazine of Mineralogy, Geochemistry, and Petrology

June 2021
Volume 17, Number 3

ISSN 1811-5209

Exploring Earth and Planetary Materials with Neutrons

DAVID R. COLE and NANCY L. ROSS, Guest Editors



Neutrons “101” – A Primer

Where’s the Hydrogen?

Nanoscale Structure and Dynamics

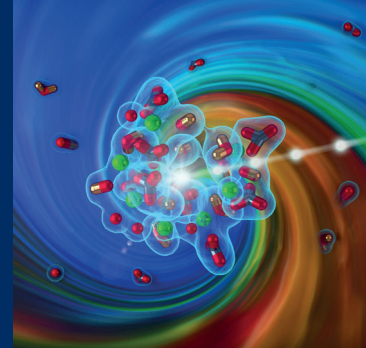
Melts, Glasses, and Amorphous Materials

Phase Transitions and Magnetism

2-D and 3-D Imaging

Elements

An International Magazine of Mineralogy, Geochemistry, and Petrology



Elements is published jointly by the Mineralogical Society of America, the Mineralogical Society of Great Britain and Ireland, the Mineralogical Association of Canada, the Geochemical Society, The Clay Minerals Society, the European Association of Geochemistry, the International Association of GeoChemistry, the Société Française de Minéralogie et de Cristallographie, the Association of Applied Geochemists, the Deutsche Mineralogische Gesellschaft, the Società Italiana di Mineralogia e Petrologia, the International Association of Geoanalysts, the Polskie Towarzystwo Mineralogiczne (Mineralogical Society of Poland), the Sociedad Española de Mineralogía, Swiss Geological Society, the Meteoritical Society, the Japan Association of Mineralogical Sciences, and the International Association on the Genesis of Ore Deposits. It is provided as a benefit to members of these societies.

Elements is published six times a year. Individuals are encouraged to join any one of the participating societies to receive *Elements*. Institutional subscribers to any of the following journals—*American Mineralogist*, *Clay Minerals*, *Mineralogical Magazine*, and *The Canadian Mineralogist*—also receive one copy of *Elements* as part of their 2021 subscription. Institutional subscriptions are available for US\$180 (US\$195 non-US addresses) a year in 2021. Contact the executive editor (jrosso.elements@gmail.com) for information.

Copyright 2021 by the Mineralogical Society of America.

All rights reserved. Reproduction in any form, including translation to other languages, or by any means—graphic, electronic, or mechanical, including photocopying or information storage and retrieval systems—without written permission from the copyright holder is strictly prohibited.

Publications mail agreement no. 40037944

Printed in USA

ISSN 1811-5209 (print)
ISSN 1811-5217 (online)

elementsmagazine.org
pubs.geoscienceworld.org/elements

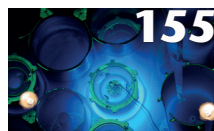
 **GeoScienceWorld**
Participating Publisher



Volume 17, Number 3 • June 2021

Exploring Earth and Planetary Materials with Neutrons

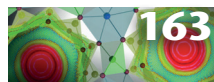
Guest Editors: **David R. Cole** and **Nancy L. Ross**



155

Neutrons "101" – A Primer for Earth Scientists

Nancy L. Ross and David R. Cole



163

Where is the Hydrogen?

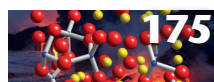
G. Diego Gatta, Klaudia Hradil, and Martin Meven



169

Nanoscale Structure and Dynamics in Geochemical Systems

Andrew G. Stack, Hsiu-Wen Wang, and David R. Cole



175

Probing the Structure of Melts, Glasses, and Amorphous Materials

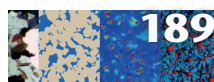
Chris J. Benmore and Martin C. Wilding



181

Probing Phase Transitions and Magnetism in Minerals with Neutrons

Bryan C. Chakoumakos and John B. Parise



189

Imaging with Neutrons

Gilberto Artioli and Daniel S. Hussey

Neutrons help us understand the structure and dynamics of many systems that are sometimes hard to characterize, such as liquids and amorphous solids. The swirling colors represent solutions rapidly mixed together to precipitate an amorphous solid (balls-and-sticks). Its atomic structure can be revealed by neutron diffraction, where the pulsed beam is shown in white. IMAGE CREDIT: ORNL/JILL HEMMAN

DEPARTMENTS

Editorial – What Have Neutrons Ever Done For Us?	147
From the Editors	148
Triple Point – Diversity Among Editorial Boards	150
Mineral Matters – A Brief History of Mineral Symbols	152
Meet the Authors	154
Society News	
Japan Association of Mineralogical Sciences	195
International Association of GeoChemistry	196
Spanish Mineralogical Society	197
Mineralogical Association of Canada	198
Société Française de Minéralogie et de Cristallographie	200
Association of Applied Geochemists	201
European Association of Geochemistry	202
Clay Minerals Society	203
Deutsche Mineralogische Gesellschaft	204
Geochemical Society	206
Mineralogical Society of America	208
International Mineralogical Association	209
Mineralogical Society of Great Britain and Ireland	210
Meteoritical Society	212
Book Review – <i>An Introduction to Metamorphic Petrology</i>	213
CosmoElements – Silicon Carbide Dust? The Answer Is Blowing' in the Wind	214
Meeting Report – Phase Equilibrium Modelling: Approaches and Pitfalls	216
Advertisers in this Issue	217
Calendar	218
Parting Shots – Vectors, Scalars, and How Science Works	219