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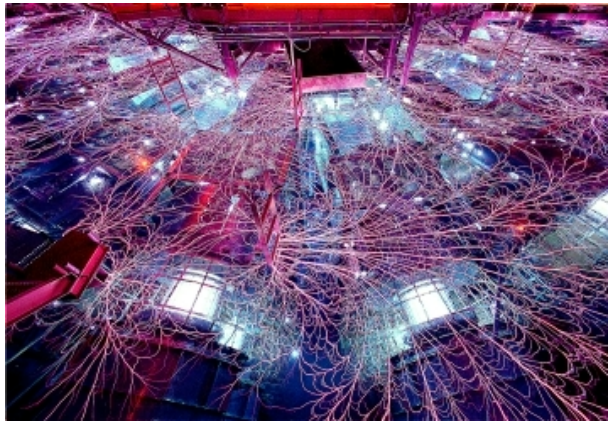
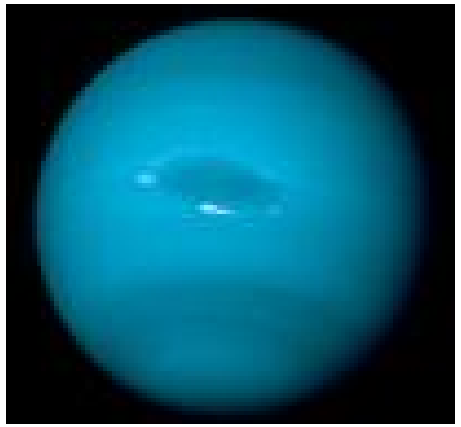
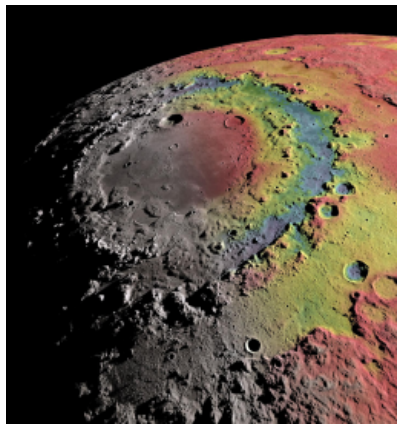
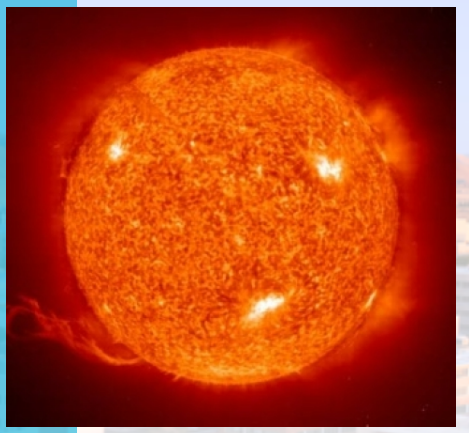
Sandia National Laboratories

Update on CY21 Call for Proposals









PRESENTED BY

Marcus D Knudson

Z Fundamental Science Workshop
9-10 August 2021

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Welcome to the 12th Z Fundamental Science Workshop

- The workshop is divided between morning Plenary sessions and afternoon Break-out sessions
  - Laboratory astrophysics — Jim Bailey, Don Winget
  - Planetary physics / Materials — Josh Townsend
  - Theory / Modeling / Computation — Kris Beckwith
  - Z-Pinch / Magnetized HED — Clayton Myers
- Break-out session agendas can be downloaded from the Workshop website

  http://www.sandia.gov/Pulsed-Power/workshop/2020.html
- Note that you are muted - this is by design
  - Please use the Chat feature to ask questions during the workshop
- If you have not done so, please send an email with your name, institution, and current position (i.e. professor, post-doc, student, etc.) to mdknuds@sandia.gov
  - In particular, if you are calling in please email me with your call in phone number so that I can identify who is calling in

12th Z Fundamental Science Workshop

- Afternoon Break-out sessions

• Laboratory astrophysics	Jim Bailey, Don Winget
• Planetary physics / Materials	Josh Townsend, Sakun Duwal
• Theory / Modeling / Computation	Andy Porwitzky
• Magnetized HED / Z-pinch	Clayton Myers, Daniel Ruiz, David Yager-Elorriaga

- Break-out session agendas can be downloaded from the Workshop website

  http://www.sandia.gov/Pulsed-Power/workshop/2021.html

- If you need links to the Break-out sessions please email Sandy Guthrie (sguthri@sandia.gov)

  Please let her know which Break-out session(s) links you would like sent

Break-out sessions begin at 1:30 pm

Agenda for Monday, August 9th

8:15 – 10:00 Plenary session opening remarks and Z Facility status:

8:15 – 8:30	Marcus Knudson, Sandia National Labs	Opening remarks
8:30 – 9:00	Dan Sinars, Sandia National Labs	Welcome and introduction
9:00 – 9:30	Nate Joseph, Sandia National Labs	Z Machine update
9:30 – 10:00	Michael Jones, Sandia National Labs	Diagnostic update

10:00 – 10:30 Break

10:30 – 12:30 Plenary session project reviews:

10:30 – 11:00	Bart Dunlap, UT Austin	The White Dwarf photosphere experiment: current status and new directions
11:00 – 11:30	Guillaume Loisel, Sandia National Labs / Patty Cho, UT Austin	Benchmarking x-ray emission from accretion-powered objects
11:30 – 12:00	Tai Nagayama, Sandia National Labs	Laboratory tests of stellar interior opacity models
12:00 – 12:30	Sarah Stewart, UC Davis	Z to planets: Super-Earth collisions and interior properties

12:30 – 1:30	Lunch break
1:30 – 5:00	Break-out sessions

12th Z Fundamental Science Workshop

- Break-out sessions

• Laboratory astrophysics	Jim Bailey, Don Winget
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  Please let her know which Break-out session(s) links you would like sent

Break-out sessions begin at 11:00 am

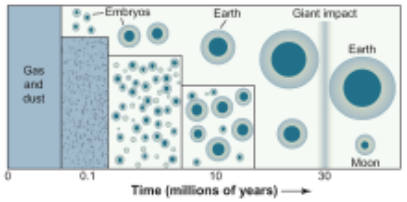
Agenda for Tuesday, August 10th

8:15 – 10:30 Plenary session opening remarks and project reviews:

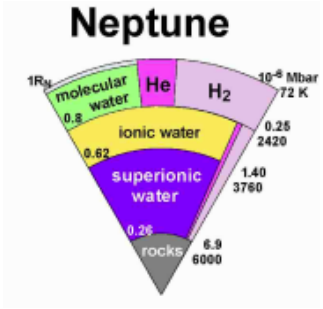
8:15 – 8:30	Marcus Knudson, Sandia National Labs Opening remarks
8:30 – 9:00	Jack Hare, MIT / Clayton Myers, Sandia National Labs Simulations and design of the Magnetically Ablated Reconnection on Z (MARZ) platform
9:00 – 9:15	Alisha Clark, UC Boulder Origin of Earth's water: role of hydrous melts at extreme P-T conditions
9:15 – 9:30	Ivan Oleynik, USF Phase transitions in SiC in the interiors of carbon-rich exoplanets
9:30 – 9:45	Steve Jacobsen, Northwestern Shockless ramp-compression of (Mg,Fe)O on the Z machine: application to ultra-low velocity zones atop the Earth's core-mantle boundary
9:45 – 10:00	Michael Springstead, U Mich Laboratory generated photoionization fronts relevant to cosmology
10:00 – 10:15	Kyle Swanson, UN Reno Chordal interferometry of the photoionized gas cell experiment on Z
10:15 – 10:30	Marcus Knudson, Sandia National Labs Update on CY21 Call for Proposals

10:30 – 11:00	Break
11:00 –	Break-out sessions

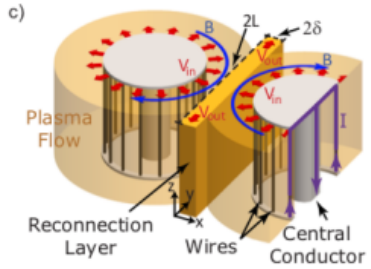
Z Fundamental Science Program is a growing community



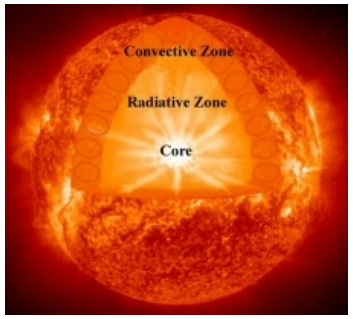
Earth and super earths



Giant Planets



Magnetic reconnection



Stellar physics

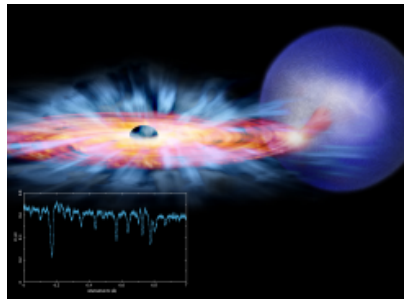
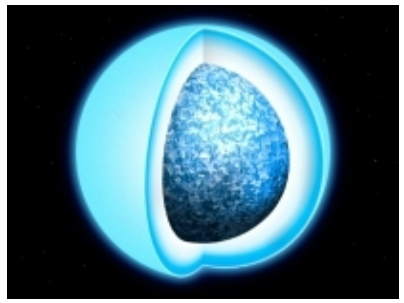


Photo-ionized plasmas



White dwarfs

12+ students are currently involved

Resources over 11 years

- 118 dedicated ZFSP shots (7.5% of all Z shots)
- Ride-along experiments on Z program shots, guns, DICE, and THOR

Science with far-reaching impact

- SCIENCE, Nature, Nature Geoscience, Nature Communications
- 7 Phys. Rev. Lett, 3+ Physics of Plasmas, 6+ Physical Review (A,B,E)
- More than 40 total peer reviewed publications and 10 conference proceedings
- 70+ invited presentations

Popular outreach

- National Public Radio, “All things considered”, 2014
- Discover Magazine
  - Reportage 9/16/2012
  - *Iron rain #62 in top 100 Science stories in 2015*
- Albuquerque Journal Front Page 9/2017
- Twice local TV coverage on planetary science

6 teams awarded shots from CY19 Call for Proposals

Nagayama et al. with Jim Bailey POC (ZAPP lead)
- Laboratory tests of stellar interior opacity models

Loisel et al. with Taisuke Nagayama and Jim Bailey POCs
- Laboratory tests of photoionized plasma emission formation for accretion-powered objects

Dunlap et al. with Taisuke Nagayama and Jim Bailey POCs
- Atomic processes in white dwarf atmospheres in the laboratory

Kuranz et al. with Taisuke Nagayama and Jim Bailey POCs New Team
- Cosmologically relevant radiation-driven heat fronts (proof-of-concept)

shots: CY20 / CY21 / CY22

ZAPP
Z Astrophysical Plasmas Project
9 shots: 2 / 5 / 2

Jacobsen et al. with Sakun Duwal POC
- Formation and evolution of Earth-like and Super-Earth planets

5 shots: 2 / 3 / 0

Redmer et al. with Chad McCoy and Sakun Duwal POCs
- Jovian planets on Z: Towards an improved understanding of Jupiter- and Neptune-like planets and the HED matter inside

4 shots: 2 / 2 / 0

Clark et al. with Jean-Paul Davis POC
- Origin of Earth's water: Role of hydrous melts at extreme PT conditions

3 shots: 1 / 1 / 1

ZFS Program transitioned to a yearly Call in CY20

- Retain 2 year Award Periods
- Assumes 14 shots per year for ZFSP
  - Hopefully this number increases as Z shot rate increases
- CY19 Call for Proposals competed for 21 allocated shots
  - This award period acts the transition
- CY20 (and later) Call for Proposals will compete for 13 allocated shots
- Beginning in CY22 there will be 1 unallocated ZFS shot per year held as a contingency
  - Used to replace “missed” shots due to schedule issues or unmet experimental objectives stemming from issues related to power flow, failed diagnostics, etc.

Assumptions:	CY20	14			
	CY21	14			
	CY22	14			
	CY23	14			
CY19 Call (Award period 7/1/20 through 6/30/22)					
				allocated	contingency
	CY20	7			
	CY21	11		21	0
	CY22	3			
CY20 Call (Award period 7/1/21 through 6/30/23)					
	CY21	3			
	CY22	7		13	1
	CY23	3			
CY21 Call (Award period 7/1/22 through 6/30/24)					
	CY22	3			
	CY23	7		13	1
	CY24	3			
CY22 Call (Award period 7/1/23 through 6/30/25)					
	CY23	3			
	CY24	7		13	1
	CY25	3			

3 teams awarded shots from CY20 Call for Proposals

shots: CY21 / CY22 / CY23

Jacobsen et al. with Jean-Paul Davis and Sakun Duwal POCs New Team

4 shots: 1 / 2 / 1

- Origin of the ultra-low velocity zones atop Earth's core-mantle boundary: shock-ramp compression of iron-rich (Mg,Fe)O

Oleynik et al. with Patricia Kalita and Tom Ao POCs New Team

4 shots: 1 / 2 / 1

- Phase transitions in SiC in the interiors of carbon-rich exoplanets

Hare et al. with Clayton Myers POC New Team

4 shots: 1 / 2 / 1

- MARZ: Magnetically Ablated Reconnection on Z

ZFS Program will need to transition again in CY21

- Retain 2 year Award Periods
- Retain yearly Call for Proposals
- Assumes 10 shots per year for ZFSP
  - Hopefully this number increases if budget pressures ease
- CY20 Call for Proposals competed for 13 allocated shots
- We will need to adjust distribution of the CY20 awarded shots
  - 2 of the shots slated for CY22 will need to be moved to CY23
- CY21 (and later) Call for Proposals will necessarily compete for fewer shots
  - 7 total shots in CY21 Call
  - 9-10 total shots in CY22 (and later) Calls

Assumptions:	CY20	14			14	0	
	CY21	14			14	0	
	CY22	10			10	0	
	CY23	10			10	0	
	CY24	10			9	1	
	CY25	10			9	1	
		previous	proposed				
CY19 Call (Award period 7/1/20 through 6/30/22)							
					allocated	contingency	
	CY20	7	7				
	CY21	11	11		21	0	
	CY22	3	3				
CY20 Call (Award period 7/1/21 through 6/30/23)							
	CY21	3	3				
	CY22	7	5		13	1	* used
	CY23	3	5				
CY21 Call (Award period 7/1/22 through 6/30/23)							
	CY22	3	2				
	CY23	7	3		7	0	
	CY24	3	2				
CY22 Call (Award period 7/1/23 through 6/30/25)							
	CY23	3	2				
	CY24	7	5		9	1	
	CY25	3	2				
CY23 Call (Award period 7/1/24 through 6/30/26)							
	CY24	3	2				
	CY25	7	5		9	1	
	CY26	3	2				

ZFS shots in CY22 and CY23

Original Plan

	2020b allocated	2020b shot	2021 allocated	2021 shot/sched	2022 allocated	2022 shot	CY19 Call allocated	CY19 Call shot/sched	2023 allocated	2023 shot	CY20 Call allocated	CY20 Call shot/sched
Redmer	2	1	2	1	1		5	3				
Jacobsen (H)	2	2	3	3			5	5				
ZAPP	2	2	5	5	2		9	9				
Clark	1	1	1	1	1		3	3				
Hare			1	1	2				1		4	4
Oleynik			1	1	2				1		4	4
Jacobsen (NW)			1	1	2				1		4	4
New					4				10			
					all from CY21 Call				7 from CY21 Call, 3 from CY22 Call			
Total	7	6	14	13	14	0	22	20	13	0	12	12

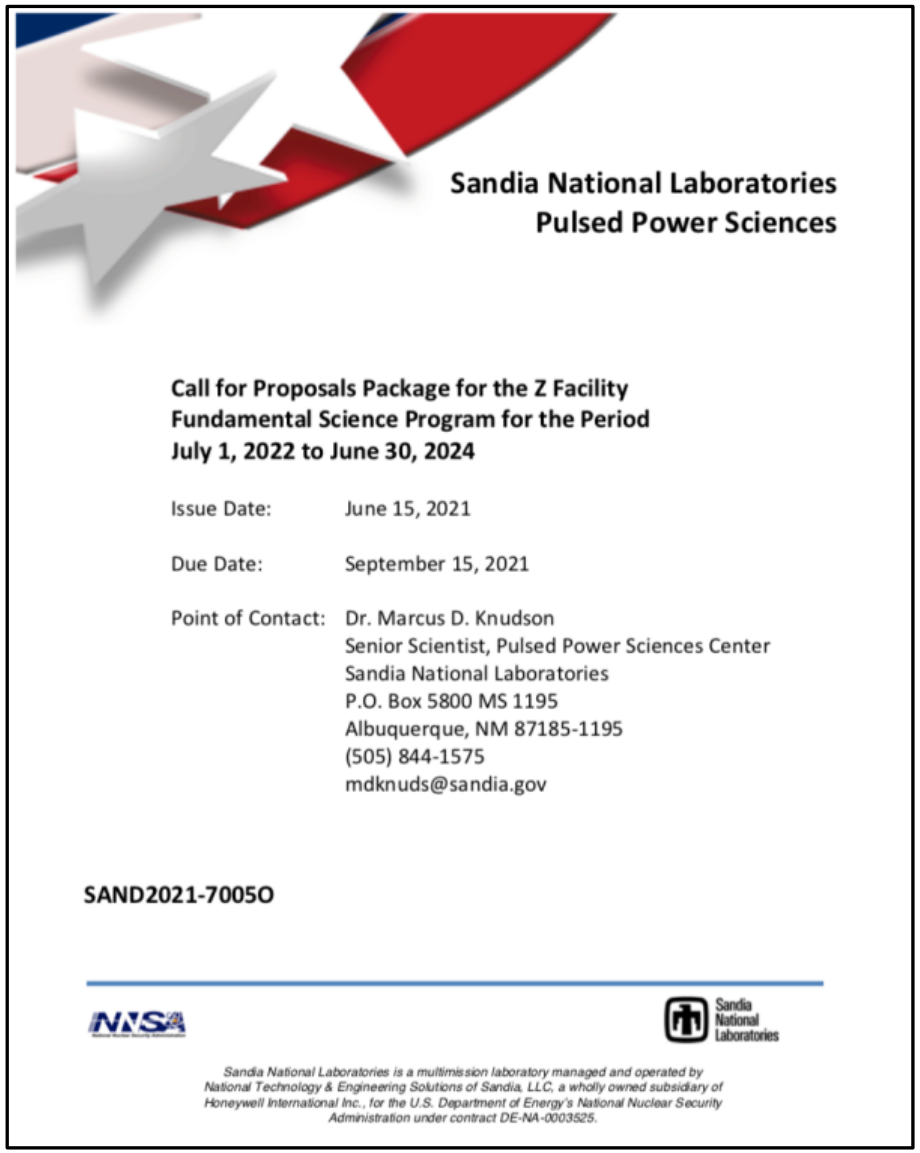
Revised Plan

	2020b allocated	2020b shot	2021 allocated	2021 shot/sched	2022 allocated	2022 shot	CY19 Call allocated	CY19 Call shot/sched	2023 allocated	2023 shot	CY20 Call allocated	CY20 Call shot/sched
Redmer	2	1	2	1	1		5	3				
Jacobsen (H)	2	2	3	3			5	5				
ZAPP	2	2	5	5	2		9	9				
Clark	1	1	1	1	1		3	3				
Hare			1	1	1	→			2		4	4
Oleynik			1	1	1	→			2		4	4
Jacobsen (NW)			1	1	2				1		4	4
New					2				5			
					all from CY21 Call				3 from CY21 Call, 2 from CY22 Call			
Total	7	6	14	13	10	0	22	20	10	0	12	12

ZFS Program 2021 Call for Proposals opened in June

- ZFSP call for proposals timeline:
  - –June 15: call for proposals open
    - Award period: July 1, 2022 through June 30, 2024
  - –August 9-10: ZFS Workshop
  - –September 15: call closes
  - –October/November: evaluation and selection
    - Facility review: experimental feasibility, safety, and diagnostics
    - Scientific review of international panel mid-November
    - Mid-December, distribution of shots
  - –Notification of Awards on Dec 15, 2021

Two-year award period



Sandia National Laboratories
Pulsed Power Sciences

Call for Proposals Package for the Z Facility Fundamental Science Program for the Period July 1, 2022 to June 30, 2024

Issue Date: June 15, 2021

Due Date: September 15, 2021

Point of Contact: Dr. Marcus D. Knudson
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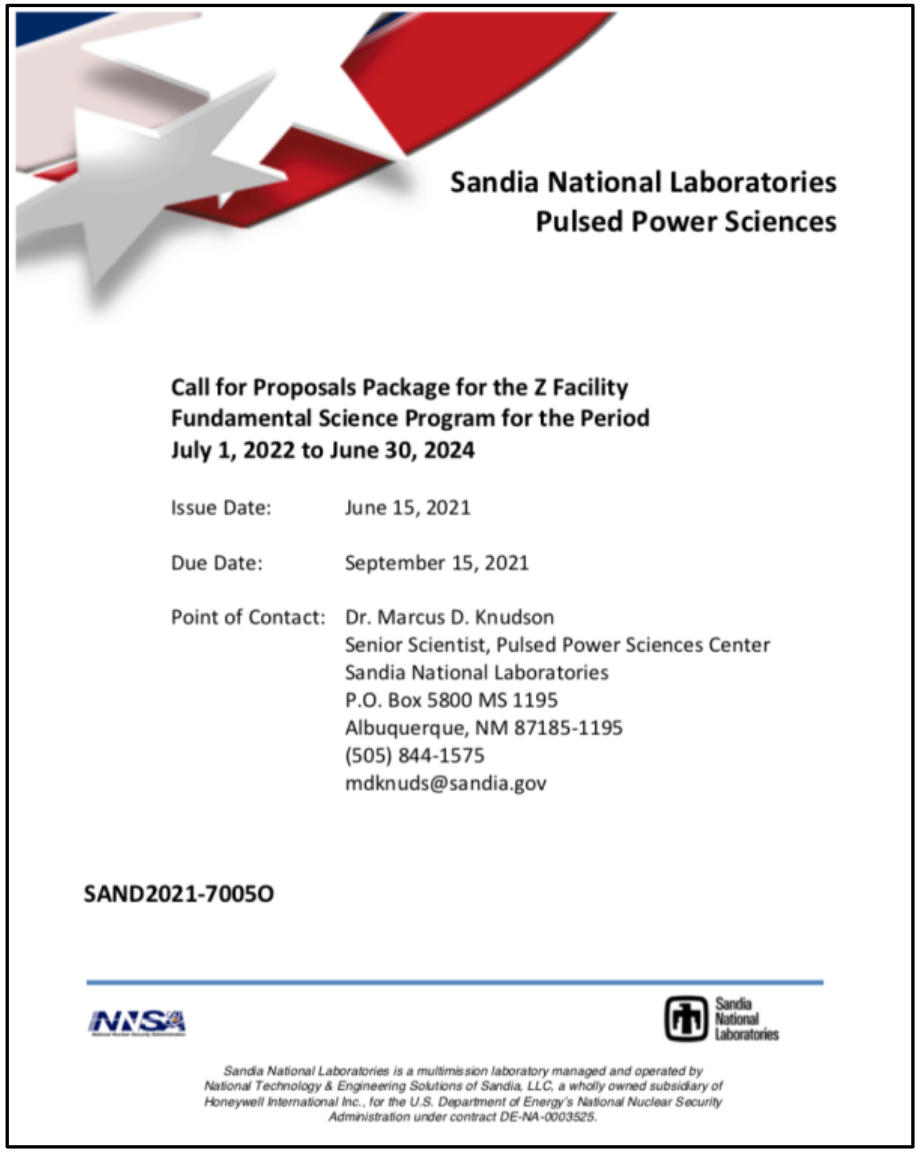
Proposals reviewed by independent, external review panel

Two-year award period

- **Applications are technically evaluated based on four scientific/technical criteria:**
  - Scientific and technical soundness and quality of the proposed method/approach, and the feasibility/likelihood of accomplishment of the stated objective
  - The overall scientific/technical merit of the project and its relevance and prospective contribution to its field of research
  - The competence, experience, and past performance of the applicant, principal investigator and/or key personnel
  - The demands of the project in terms of resource requirements (equipment, beam time, etc.) and/or other requirements (facility hardware modifications, component development, etc.) vis-à-vis competing demands.



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