

Student questions: Dr. Sumner Starrfield colloquium on “Lithium from the Big Bang to Batteries and Points Between”

11/10/21

The two (2) detected direct spectral lines from the explosive production of Li-7, do they have similar or the same recoil energy?

They are absorption lines at roughly the same energy. Recoil???

The electron neutrino that accompanies every beryllium to lithium decay, is it the same as the detected spectral lines that you mentioned during the talk?

Neutrinos are particles. Spectral lines are photons.

Do you think there's room for new discoveries that will dramatically change how we think the Big Bang happened?

Of course

What other elements do you think have interesting lifecycles through the universe?

All of them

You mention when comparing the abundances of Fe and Li that Lithium-7 is very fragile. What contributes to the element's fragility compared to other elements and isotopes of Lithium?

It has a reaction cross section that allows nuclear reactions at low temperatures.

When talking about Recurrent Novas you said that one way for them to occur is for a White Dwarf and a Red Giant interact with each other because of their proximity. How common is this occurrence, and are there other ways to create Recurrent Novas?

NO. There are about 20 RN in our galaxy.

What is a helium runaway?

The temperatures and densities get high enough for the triple-alpha reaction to become important.

Why does a WD explosion increase much faster with more carbon?

^{12}C is a catalyst in the CNO cycle. Take AST 111 or 112.

What does this have to do with geosciences?

Nothing. A large fraction of SESE is astrophysics not geo stuff.

You mention that there isn't enough matter to "close" the universe to make it expand forever. If the universe isn't going to expand forever, how long do you think it will take for the universe to stop expanding? or when is the great freeze going to happen?

The universe will expand forever and the expansion is accelerating. Take AST 112.

How often do you come across a problem where the projected simulations had to be completely remade after new observations were made?

Lots of times

I've noticed that a lot of references to pop culture are made in scientific discoveries, such as that supernova looking like the Eye of Sauron. Do you have a favorite example of pop culture making its way into your work?

That was a joke.

How long does it usually take to run your computational simulations?

A couple of hours

In addition to classical novae, what do you suspect might be other sources of Lithium in the universe?

Asymptotic Red Giants

Since researching the Universe's oldest stars as a source for Lithium-7 can teach us about early cosmological conditions, could studying gamma-ray burst afterglows at high redshift reveal gamma-ray bursts/their progenitors as another possible early source and be connected to its presence in our galaxy?

Take AST 112 -you are confusing the last couple of chapters.

What is the significance of including Be-7 in the stable element production plots of Lithium-7 shown?

How much ${}^7\text{Li}$ is being produced by the simulations.

What type of meteorites do you use to determine ${}^7\text{Li}$ in the Galaxy?

SiC

How is ${}^7\text{Li}$ measured in stars?

Absorption lines in stellar spectra

How do we know (or calculate) the temperature required for ${}^7\text{Li}$ formation?

Measuring the nuclear cross sections in the laboratory

How will the JWST enhance your research, if at all?

It is an infra red telescope that allows us to study elements that are not emitting lines in the visible

Are these early elements found in any of the oldest rocks?

Ask a meteoriticist

Can you find and date the lithium in zircons since they are like little time recorders for the geosciences?

Ask a meteoriticist

What sort of mechanism may be missing to explain why simulations don't match observation of ${}^7\text{Li}$ production?

If I knew the answer I would have published it already

Are all nova enriched in a similar way or does it depend on the region/age?

Depends on white dwarf mass, composition, mass accretion rate, ...

Has ${}^{26}\text{Al}$ ever been detected in any kind of spectra?

Yes with ALMA

How would you search for ${}^7\text{Li}$ in a meteoritic sample?

Ask a meteoriticist

Why are there such big variations in the X-ray count rates?

We don't know

Why is ${}^{26}\text{Al}$ important in the solar system?

Ask a meteoriticist

What are the assumptions that must be made when looking back at elements from billions of years ago?

Take AST 111 and 112

In the simulations of stars exploding, is there ever a new element that was formed that wasn't discovered before?

NO

What are the disadvantages of lithium-ion batteries?

???

How often do Nova explosions occur?

About 10 to 15 per year

What are the mechanisms that move elements such as lithium around the universe after they form in stars?

The are exploded at high velocities

What controls the spatial variability of lithium concentrations between different galaxies or stars?

Magnetic fields

What is the importance of the peak luminosities of some novae exceeding the Eddington luminosity?

Google Eddington Luminosity

How far away could we detect Lithium 7 in novae?

They must be bright for high dispersion studies

Do different galaxies have different frequencies/incidences of novae phenomenon?

Yes

How much influence do novae have collectively on galactic composition compared to other astronomical events?

Slight

How do we know with high confidence that our lithium estimate for the universe is accurate?

Ask a meteoriticist

What other mechanisms could form ${}^7\text{Li}$ besides the decay of ${}^7\text{Be}$?

Google Spallation

Would we only find He3 and He4 in the center of old stars?

Take AST 112

Do reoccurring novae only happen in white dwarf-red giant binary systems or can they happen in other type of binary pairs?

Only in wd-rg systems

For codes used to model accreted material, are specific "carriers" for elements of interest (such as ${}^7\text{Be}$) used?

???

What do you think is the greatest advantage to using a 1D model verses a multi-dimensional one when considering mixing in solar accretions?

You can do more simulations per unit time.

What is the "turn off" branch of a star?

Take AST 112

What size star novae emit 10^{-4} solar masses, or is it all novae?

Take AST 112

What is Diffusion Theory?

Google it or take a course in Statistical Mechanics

What is the difference between a classical nova and a supernova?

Take AST 112

What causes Novae to recur?

The white dwarf survives the explosion and accretion stars over

Other than a critical mass, is there any cosmic influence that causes thermonuclear runaway?

??

Do you believe we will continue to see further and further into the unknown universe or will there be a point where we can no longer see?

Take AST 112

What's the fastest pulsar we know of?

Google it

What exactly does ionization of the ejecta mean?

Take any beginning astronomy course

What does it mean for proton captures to be fast enough for O15, and the like to become the most abundant of the CNO nuclei?

The reactions happen very fast at high temperature

What is the typical recurrent rate of the known novae?

1 to 100,000 years

For known novae that we have taken measurements of reoccurrence, is there any change to the lithium production rate generated by different events of the same binary star pair?

Under study

How and why was cluster NGC 6397 chosen?

Ask the authors

Would it be possible to collect the elements ejected during these nove since some go off at regular frquent interals?

Collect?

Are there competing theories to the big bang that have support in the scientific community?

no

What causes recurrence in novae?

The white dwarf survives the explosion and accretion stars over

What are the parameters for the simulations of the ejections?

Read the papers

What are nova events frequency dependent on?

Wd mass, composition, temperature, mass accretion rate

Where is the best location to be, latitude and longitude, to get the data needed to find these binary systems?

An observatory

Given the high proportion of binary star systems to singular star systems, is it possible for trinary star systems to come into play?

Anything is possible in astronomy

Is there any relationship between the abundance of Li isotopes with the ages of the galaxies?

Possibly

Can Li isotopes be used as conclusive evidence for the explosion of white dwarfs?

Not really

What is the shortest time possible between novae recurrence?

1 year

Are there other types of novae, other than CO and ONe, that can produce lithium-7?

There are no other types