PAN - 2018 - Questions based on nuclear Energy Density Functional theory

```
The program we use is setup with a particular parameter set called Skyrme Skx.
This is specified in the file param.den in the code directory.

Web page for the nuclear chart:
https://people.nscl.msu.edu/~brown/chart/chart-levels.html
```

1. Where is the proton drip line for A=32 and how does it compare with experiment?

2. Where is the neutron drip line for A=32 and how does it compare with experiment?

3. How do the nuclei ^{32}Ar and ^{32}Mg decay?

4. Calculate the properties of ^{34}Si. This is called a bubble nucleus for protons because of the hole in the proton density near the center. Why does this happen?

5. What is the predicted total angular momentum for the ground state of ^{49}Ca? How does it compare with experiment?

6. The very neutron-rich calcium isotopes will be studied by FRIB. Is the nucleus ^{60}Ca inside the neutron drip line? Do you expect this to be a magic nucleus for protons and/or for neutrons?

7. Do you expect ^{70}Ca to be inside the neutron drip line?

8. Do you expect ^{71}Ca to be inside the neutron drip line?

9. What is the predicted total angular momentum for the ground state of ^{61}Ca?

10. Calculate the properties of the heaviest nucleus observed, ^{294}Og ($Z = 118$). Why is the total density low in the inside? Is this a magic nucleus for protons and/or neutrons?