Week 10 Report
Spring 2019

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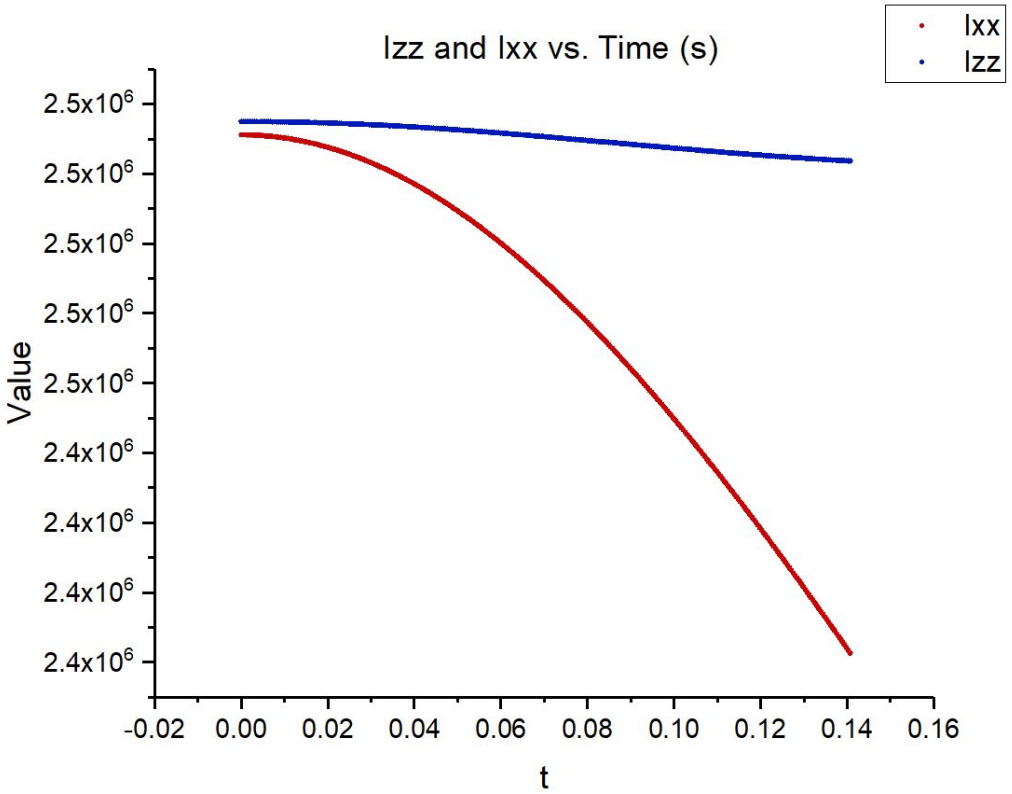
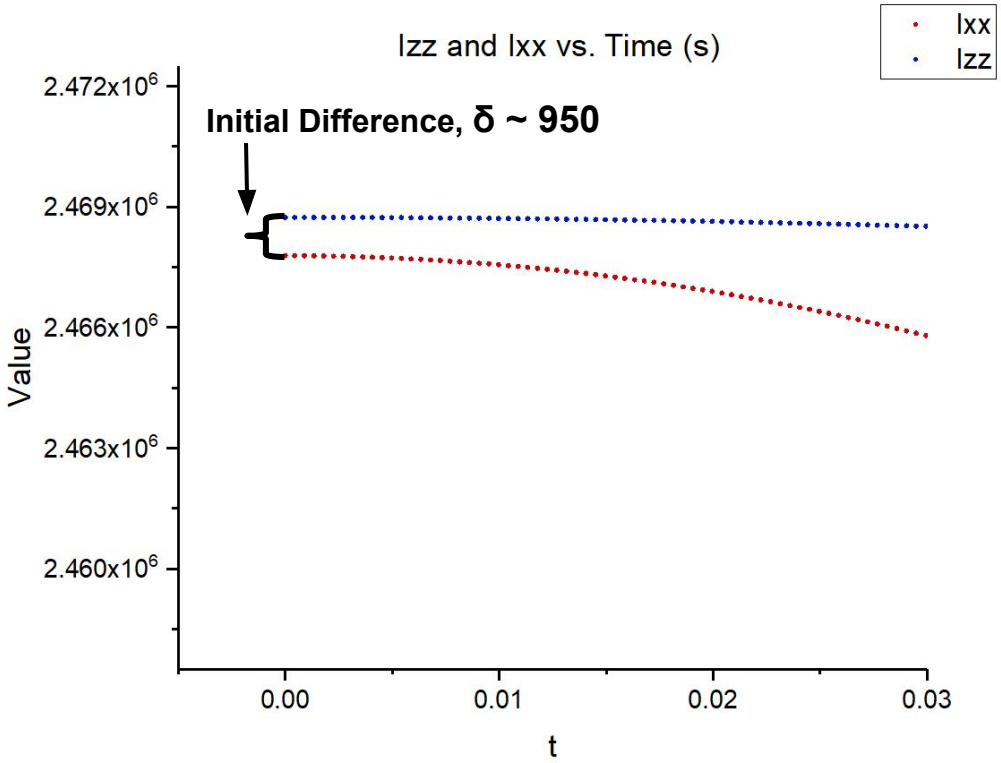
Moment of Inertia Component Evolution

Using very strong field for testing, B ~ 10^{16} G near surface.



Zooming In On t = 0...



Analytic Calcs for Izz, Ixx at t = 0

$$\texttt{Ixxstar} = \int_0^{2\pi}\int_0^{\pi}\int_0^{R} \texttt{rho1[r]} * \left(\left(\texttt{r} * \texttt{Sin}[\theta] * \texttt{Sin}[\phi]\right)\texttt{\^{}2} + \left(\texttt{r} * \texttt{Cos}[\theta]\right)\texttt{\^{}2}\right) * \texttt{r}^2 * \texttt{Sin}[\theta]\, \texttt{dr}\, \texttt{d}\theta\, \texttt{d}\phi$$

$$\frac{8\left(\pi^2 - 6\right) R^5 \,\text{rhoc}}{3\,\pi^3}$$

$$\texttt{Izzstar} = \int_0^{2\pi}\int_0^{\pi}\int_0^{R} \texttt{rho1[r]} * \left(\left(\texttt{r} * \texttt{Sin}[\theta] * \texttt{Cos}[\phi]\right)\texttt{\^{}2} + \left(\texttt{r} * \texttt{Sin}[\theta] * \texttt{Sin}[\phi]\right)\texttt{\^{}2}\right) * \texttt{r}^2 * \texttt{Sin}[\theta]\, \texttt{dr}\, \texttt{d}\theta\, \texttt{d}\phi$$

$$\frac{8\left(\pi^2 - 6\right) R^5 \,\text{rhoc}}{3\,\pi^3}$$

Izz = Ixx!

Updated Boundary Conditions

- Old BCs for pure fields taken out, replaced with expressions for mixed field
- Boundary Conditions
  - r = 0
  - r = 2.0
  - Θ = 0
  - Θ = π

B_r Boundary Condition for r = 0:

```
B0[θ_] = Limit[Br[r, θ], r → 0]
```

$$-\frac{2\pi^2 \text{Bmax}\cos(\theta)\left(2\pi\lambda^3+\left(1-3\lambda^2\right)\sin(\pi\lambda)+\pi\left(3\lambda^2-1\right)\lambda\cos(\pi\lambda)\right)}{3\left(\lambda^2-1\right)^2(\pi\lambda\cos(\pi\lambda)-\sin(\pi\lambda))}$$

B_Θ Boundary Condition for r = 0:

```
B0T[θ_] = Limit[Btheta[r, θ], r → 0]
```

$$\frac{2\pi^2 \text{Bmax}\sin(\theta)\left(2\pi\lambda^3+\left(1-3\lambda^2\right)\sin(\pi\lambda)+\pi\left(3\lambda^2-1\right)\lambda\cos(\pi\lambda)\right)}{3\left(\lambda^2-1\right)^2(\pi\lambda\cos(\pi\lambda)-\sin(\pi\lambda))}$$

B_ϕ Boundary Condition for r = 0:

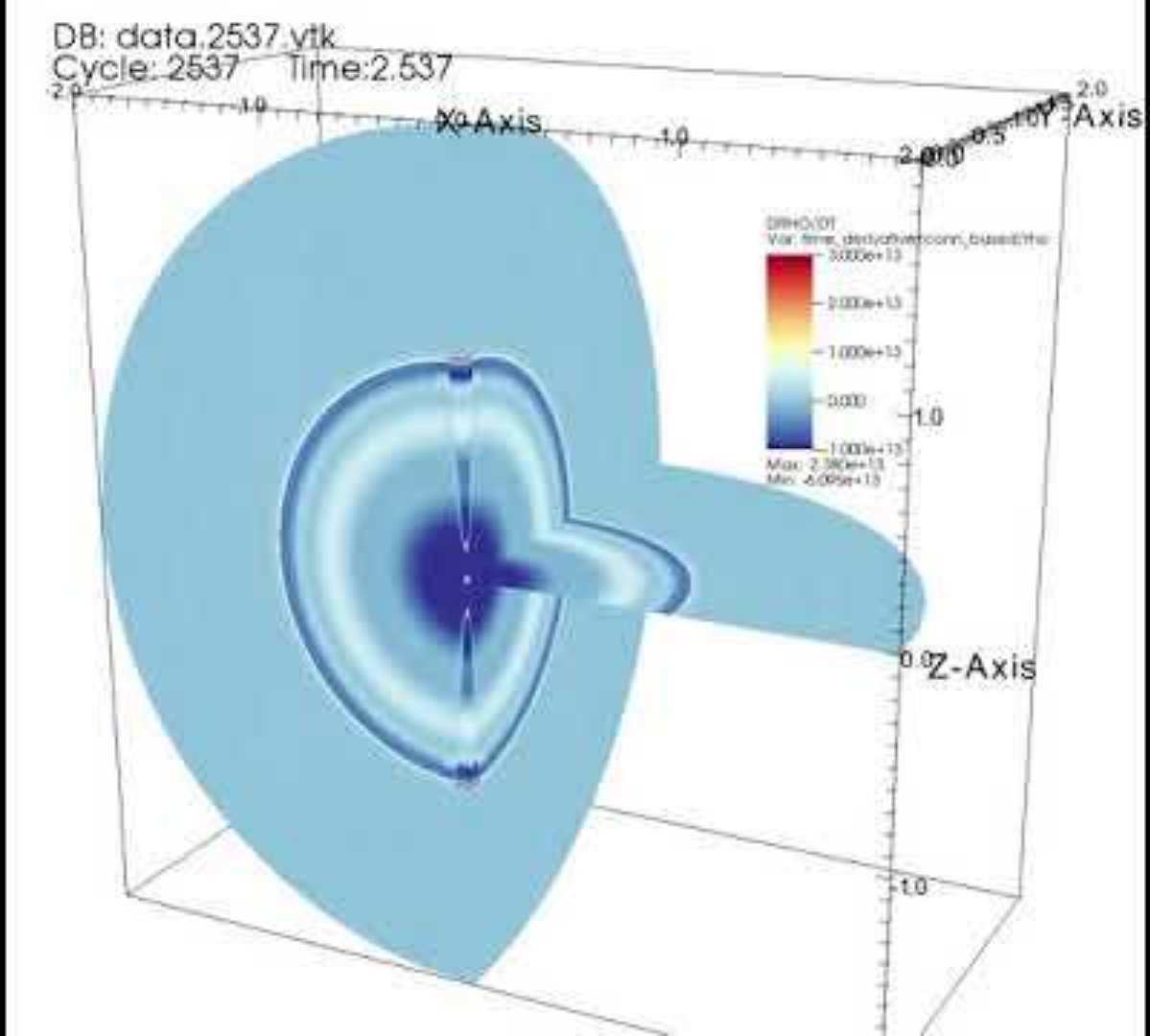
```
B0P[θ_] = Limit[Bphi[r, θ], r → 0]
```

0.

BCs for r = 0

Continued Work

- Running more simulations for Izz and Ixx values
  - Vary B-field strength
  - Vary λ parameter
- Fix weird density issue (see next slide)
  - Likely has something to do with r = 0 boundary


DB: data.2537.vtk
Cycle: 2537 Time:2.537
X-Axis
Y-Axis
Z-Axis
2.0
1.0
0.0
0.5
1.0
1.0
2.0
1.0
0.0
1.0