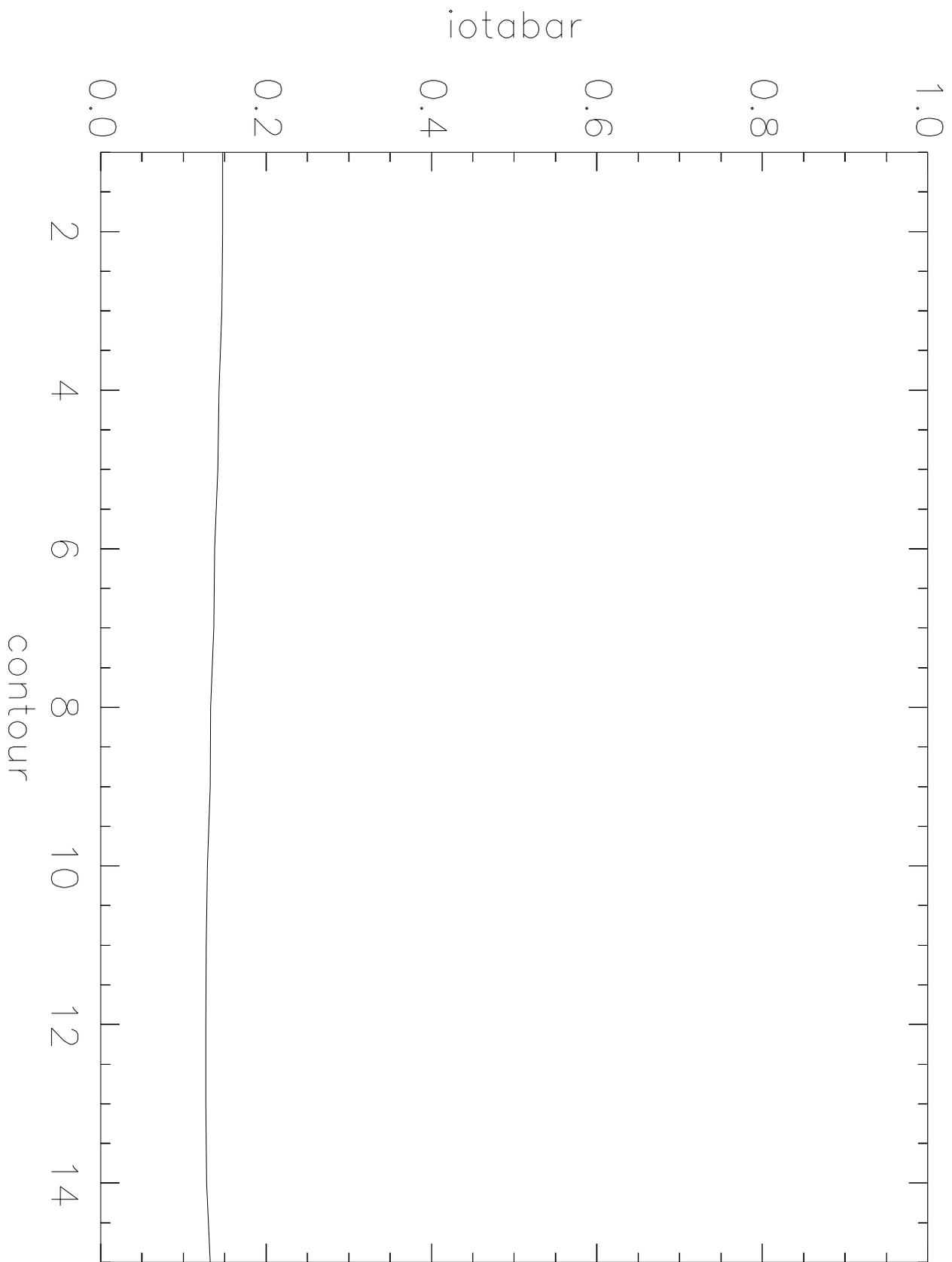
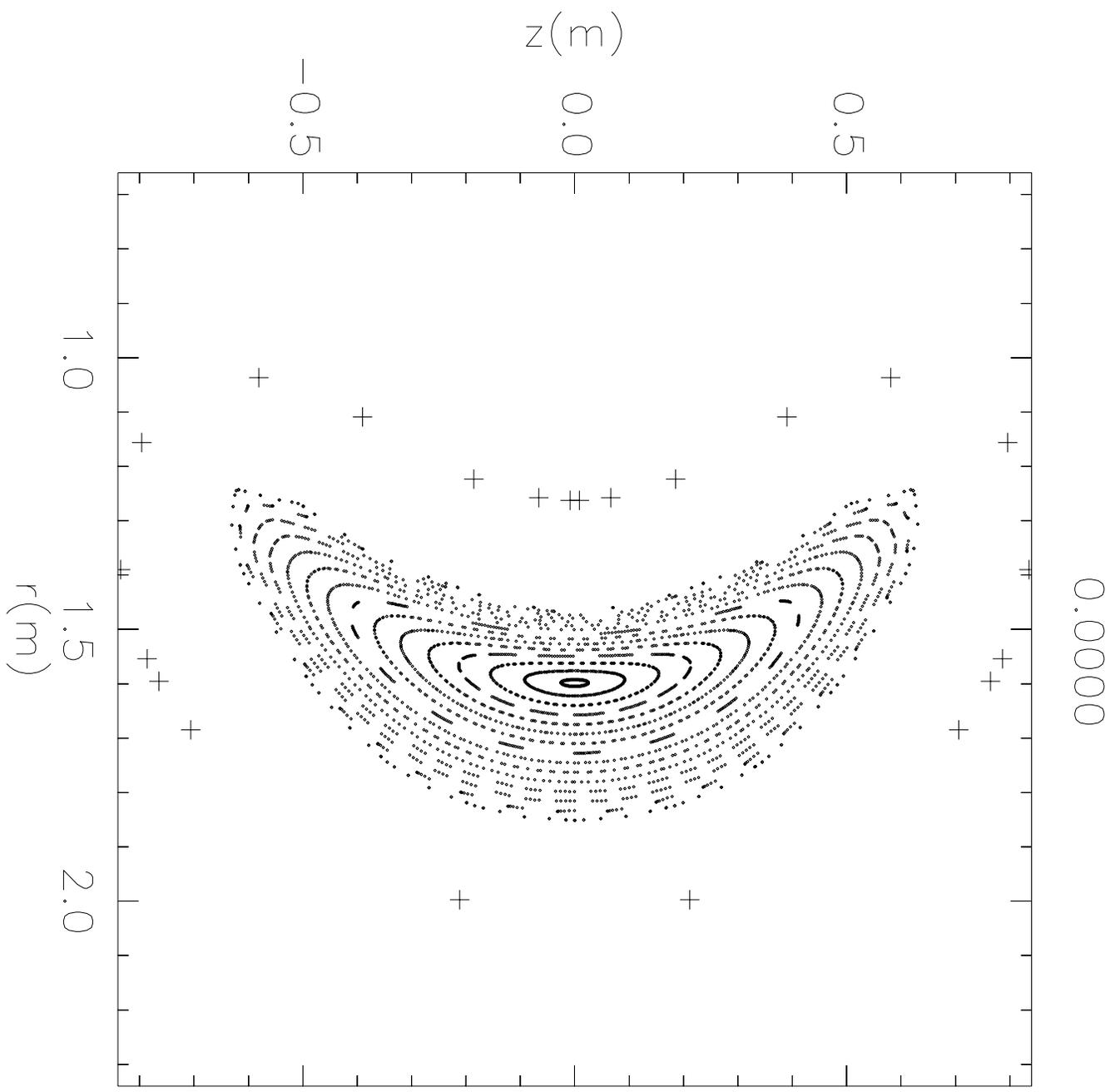


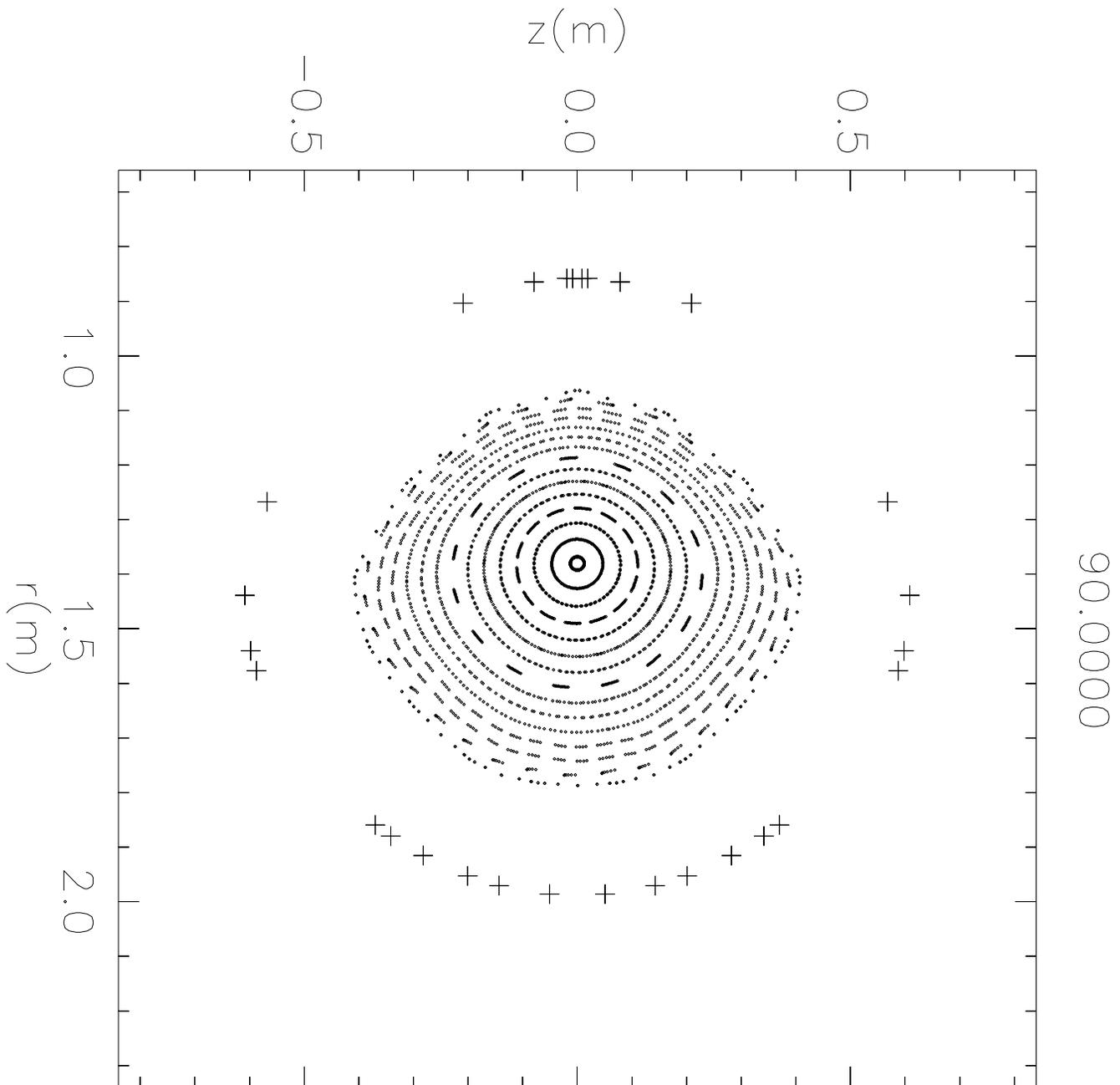
## ORNL Presentations at the NCSX Physics Meeting of 8/28/98

There were two ORNL presentations at the 8/28/98 NCSX Physics video conference with PPPL and UT-Austin. Raul Sanchez reported on recent progress on developing fast methods for calculating ideal ballooning stability. This of importance to us because we would like to incorporate the ballooning calculation in the configuration optimizer. Six different algorithms were compared with respect to the time it took to calculate an eigenvalue on a single flux surface: Shooting methods using 1) a fixed grid (FSHOOT) and 2) an adaptive grid (ASHOOT); 3) Inversion of the matrix resulting from a finite-difference formulation of the ballooning equation (MATRIX); Variational formulations using 4) a test function which is a sum of the 3 lowest order Hermite polynomials weighted by a gaussian (VHERM3) and 5) a test function consisting of a sum of 3 arbitrarily centered gaussians; and 6) the TERPSICHORE ballooning code. A Richardson scheme was used with VHERM3, MATRIX and FSHOOT to extrapolate the eigenvalue to zero grid size. These three algorithms were comparable in speed, and were 4 times faster than TERPSICHORE, 7 times faster than ASHOOT, and 120 times faster than VGAUSS. THE TERPSICHORE calculation could be speeded up by reducing the number of points used along a field line, but this is not done automatically. An additional factor of 5 improvement in speed can be gained for the algorithms other than TERPSICHORE by optimizing the Boozer conversion algorithm. **The figures are on the QOS web page under "[ORNL Activities on NCSX](#)" listed with the title "Fast Methods for Ideal Ballooning Stability Determination in 3-D Configurations by R. Sanchez et al."**

Steve Hirshman reported on recent studies of magnetic field reconstruction for reverse-engineered coils. Two-period vacuum fields were used for these studies. The initial field used had a nearly flat vacuum iota, ranging from about 0.15 at the axis to about 0.14 at the edge. In discretizing the corresponding sheet current on the winding surface to construct coils, a mixture of helical and saddle coils were retained. This contrasts with the previous treatment, which neglected the small helical components of the sheet current and retained only saddle coils. The new approach now yields a good reconstruction of the field, both with a vacuum field code and with VMEC. As the rotational transform was raised by decreasing the toroidal field, islands were observed in the vacuum field as the transform passed through low order rational values. VMEC continued to converge well for these cases. **The figures for this presentation are on the following pages.**

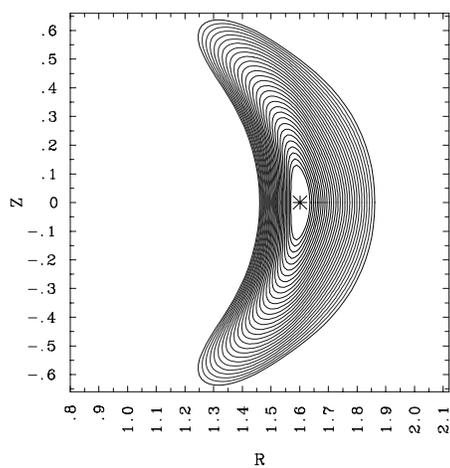




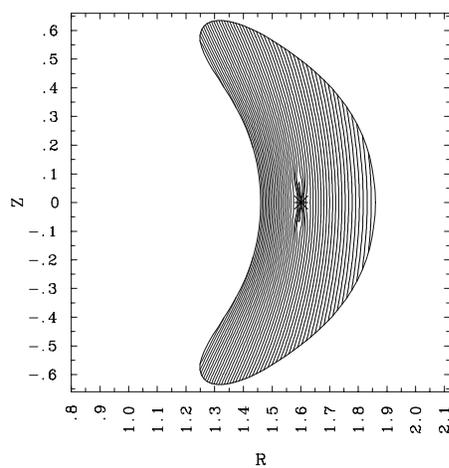


$$N_f \varphi = 0^\circ$$

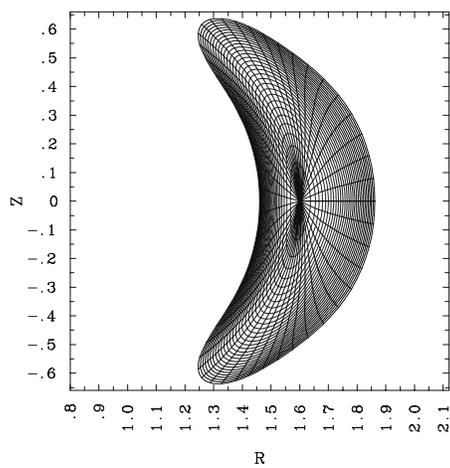
CONTOURS OF  $\sqrt{\phi}$



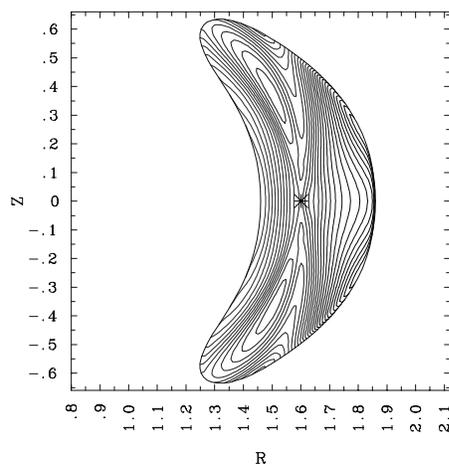
MOD-B CONTOURS



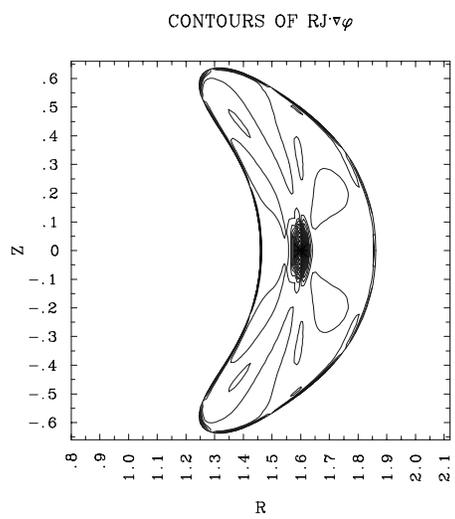
$\phi$  and  $\psi$  CONTOURS



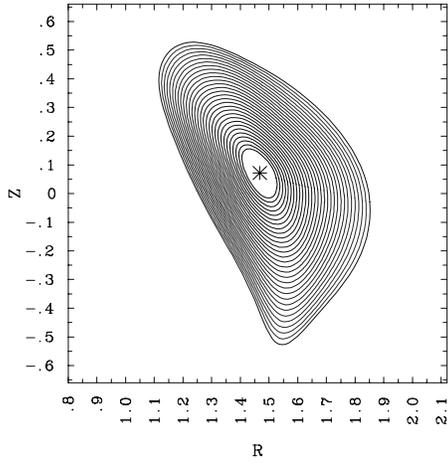
JACOBIAN CONTOURS



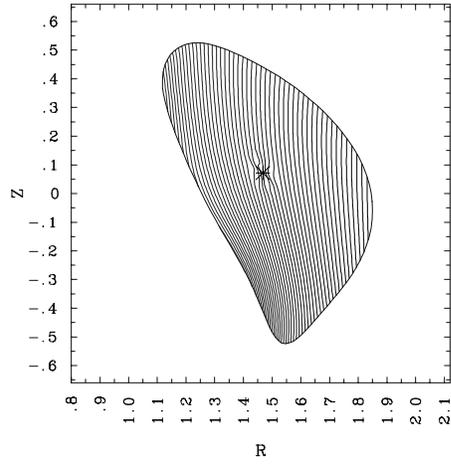
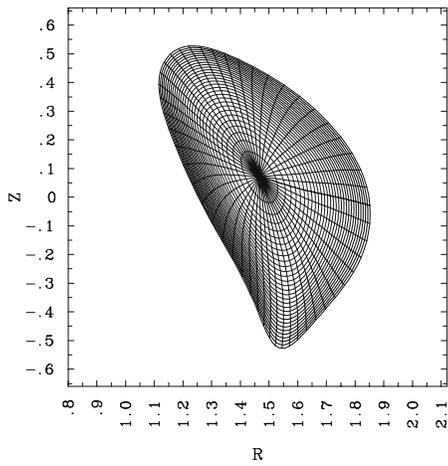
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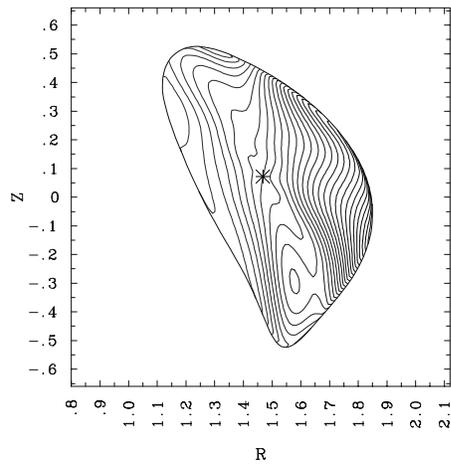
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CONTOURS OF  $\sqrt{\phi}$ 

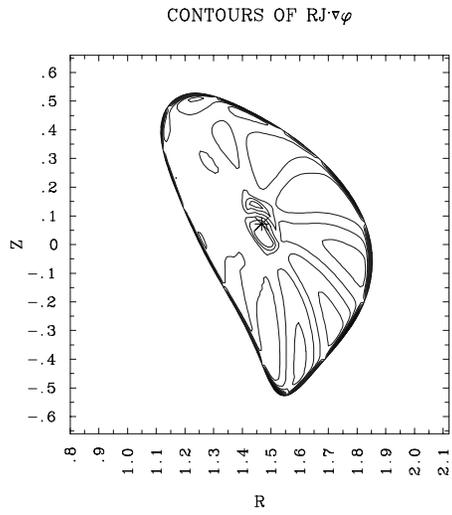
MOD-B CONTOURS

 $\phi$  and  $\varphi$  CONTOURS

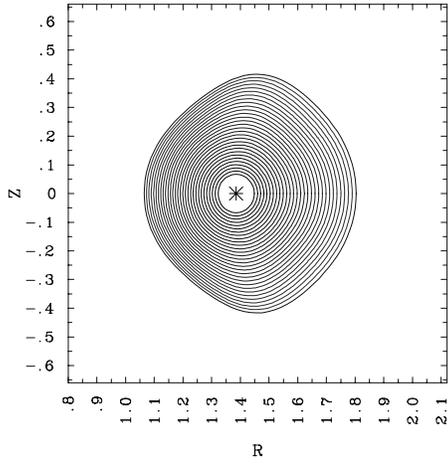
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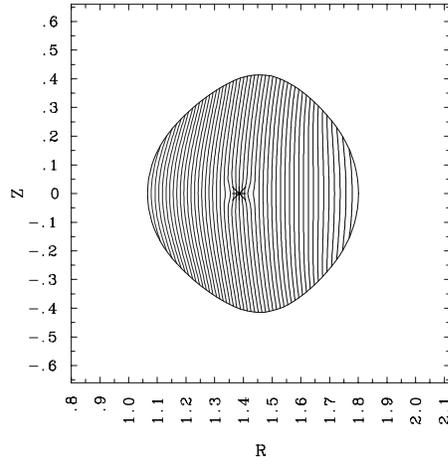
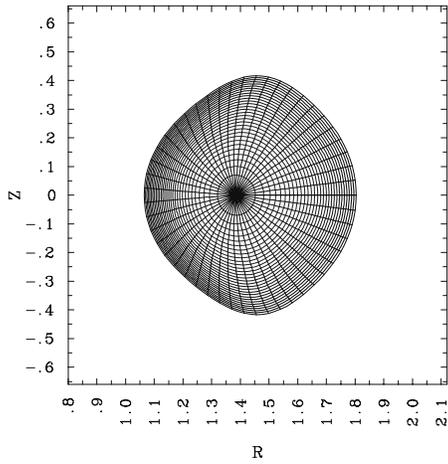
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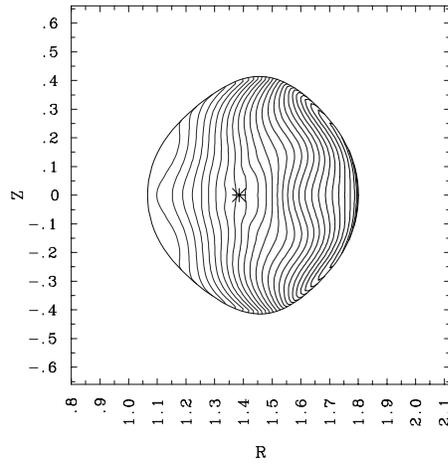
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CONTOURS OF  $\sqrt{\phi}$ 

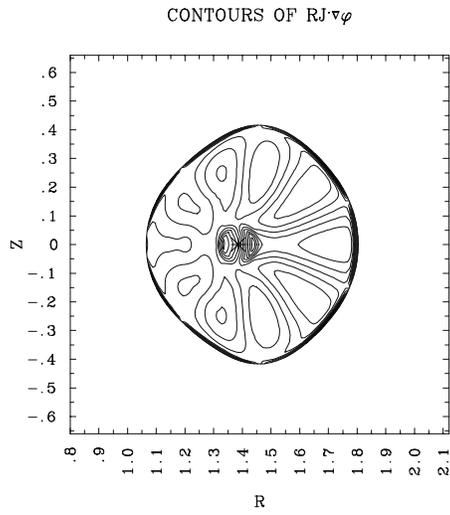
MOD-B CONTOURS

 $\phi$  and  $\varphi$  CONTOURS

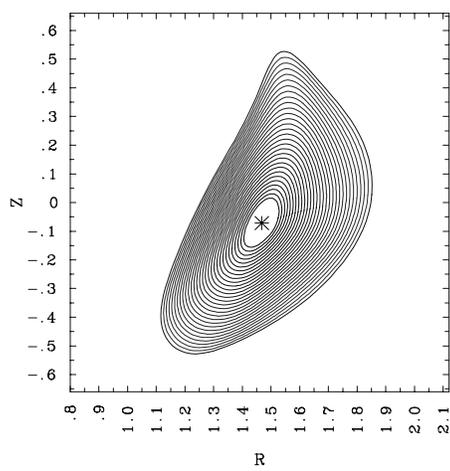
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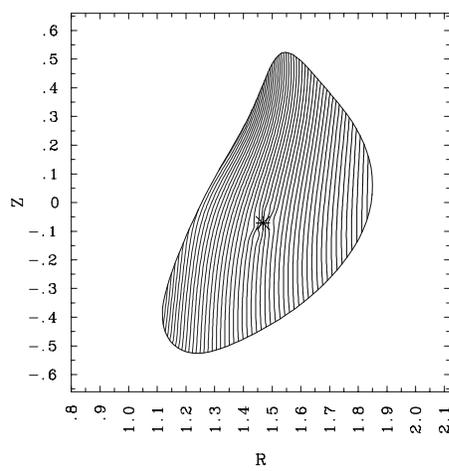
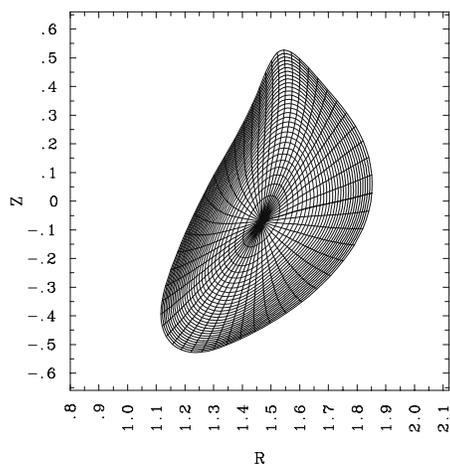
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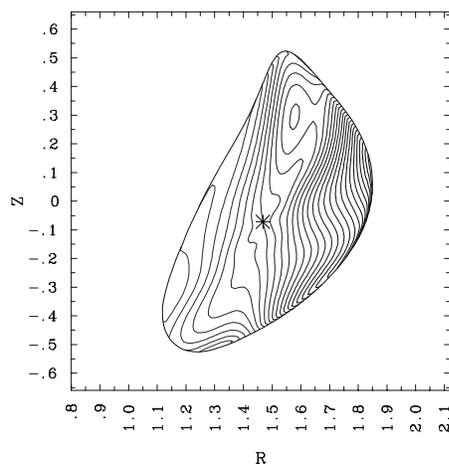
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CONTOURS OF  $\sqrt{\phi}$ 

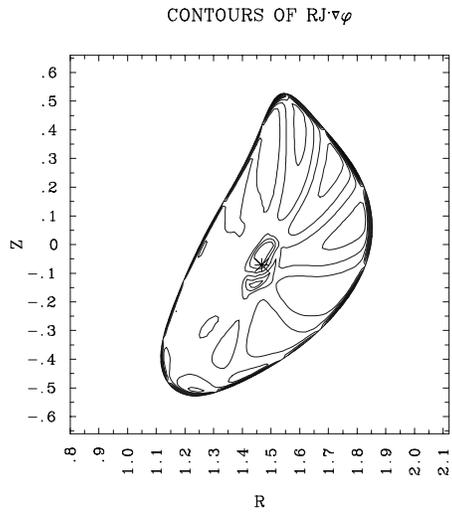
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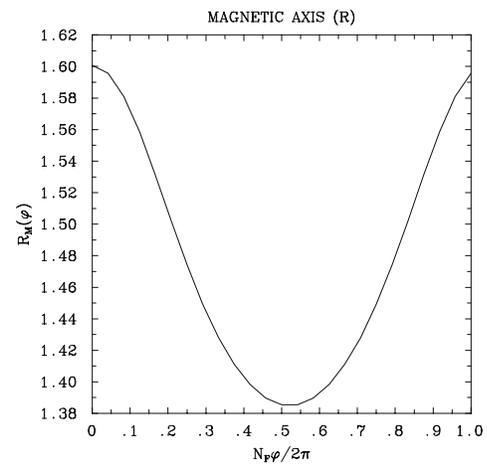
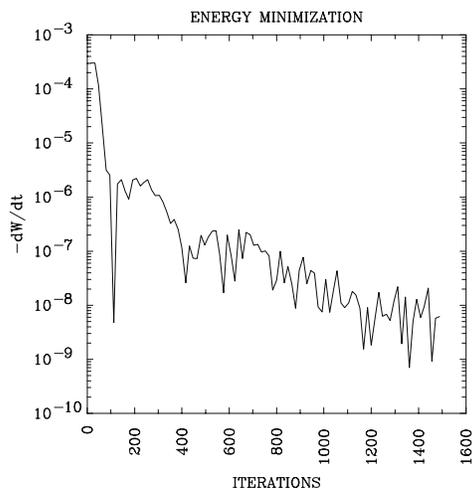
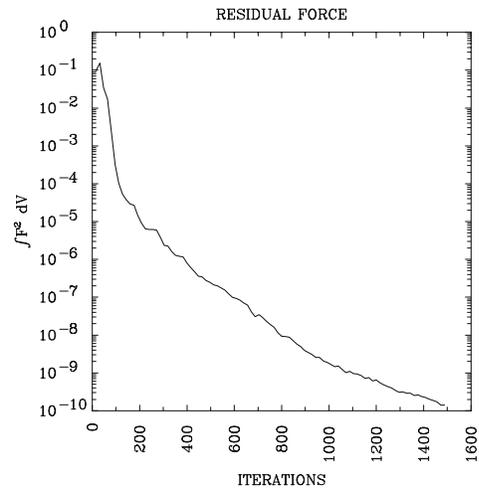
 $\phi$  and  $\psi$  CONTOURS

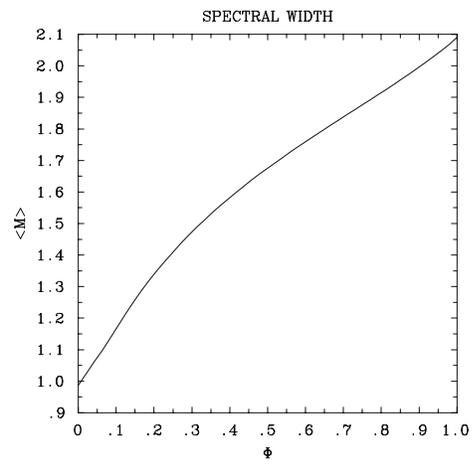
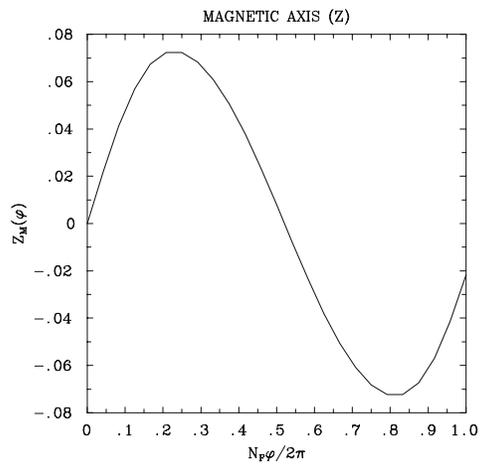
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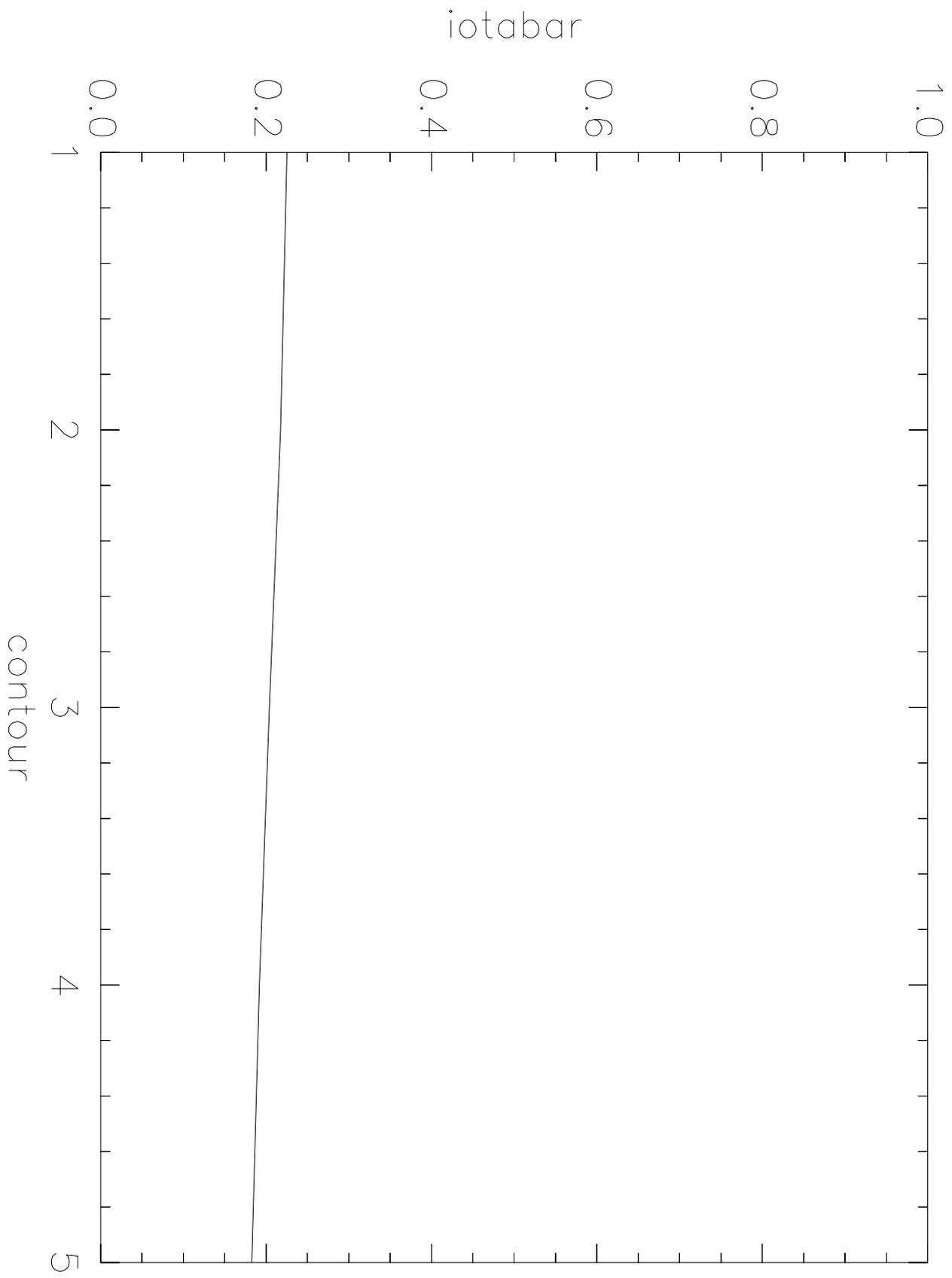


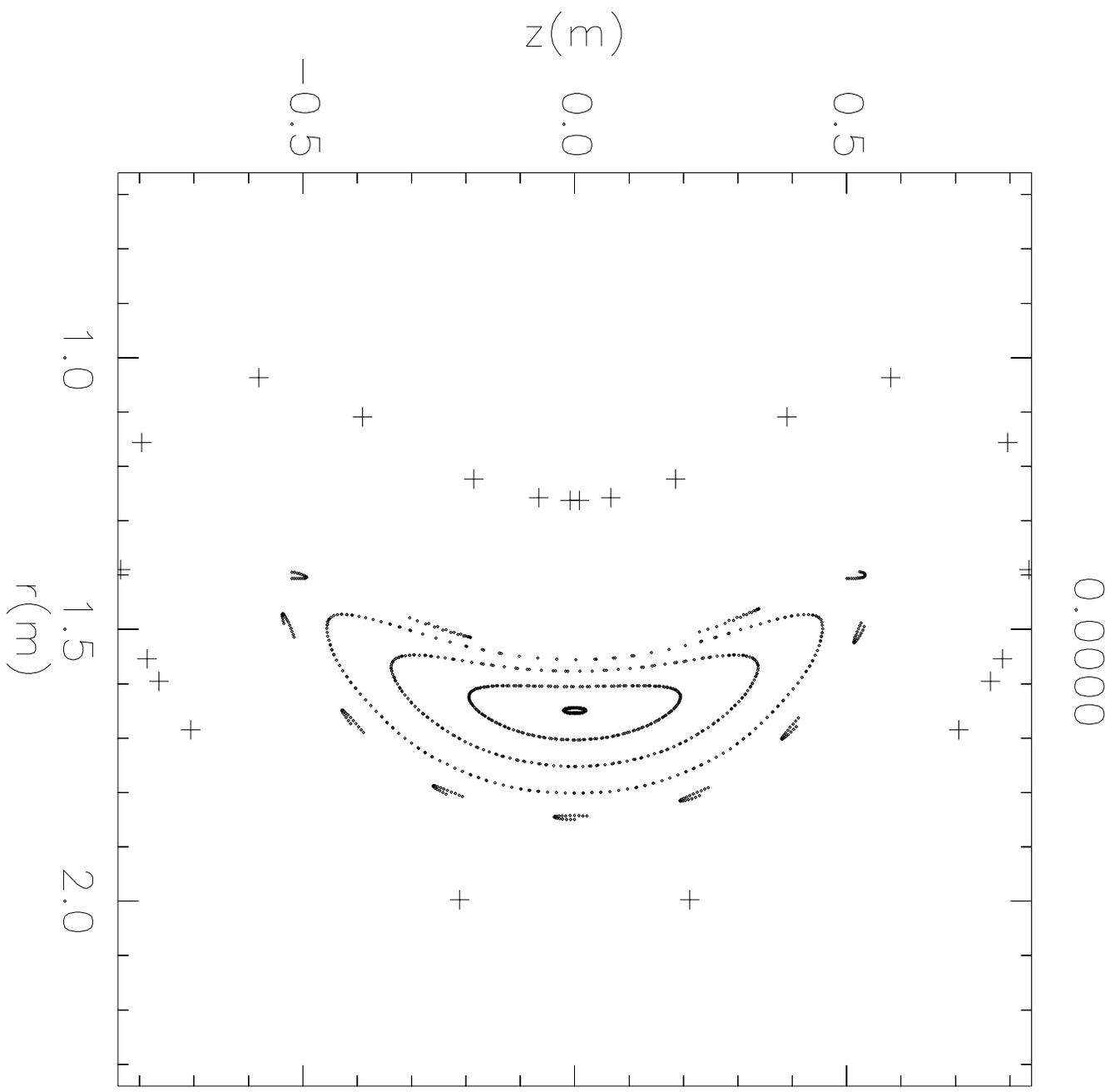
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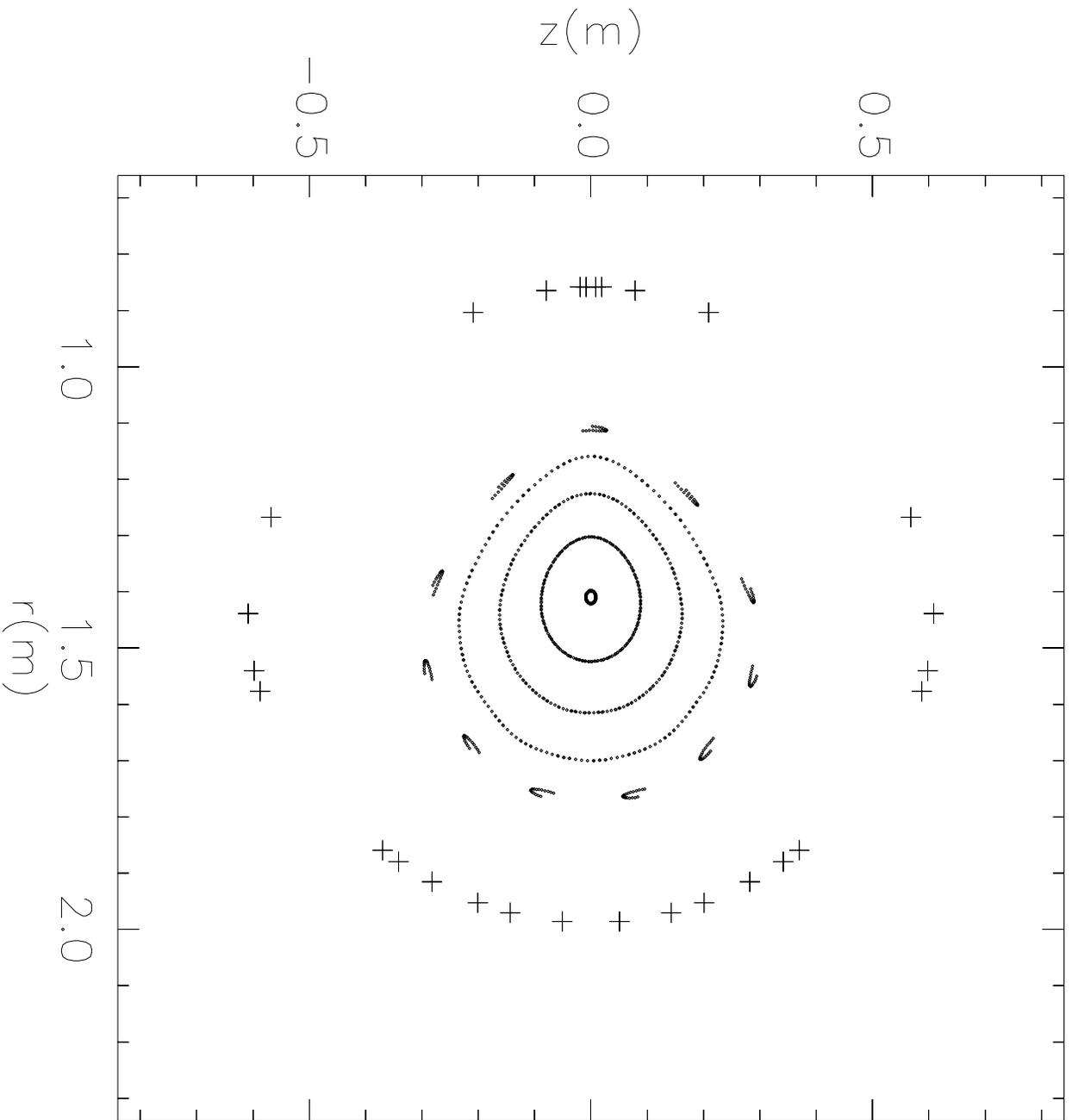






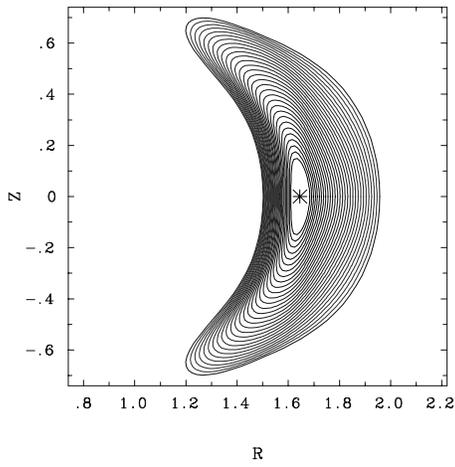


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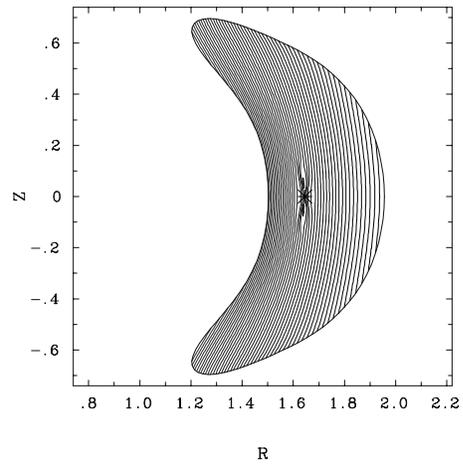


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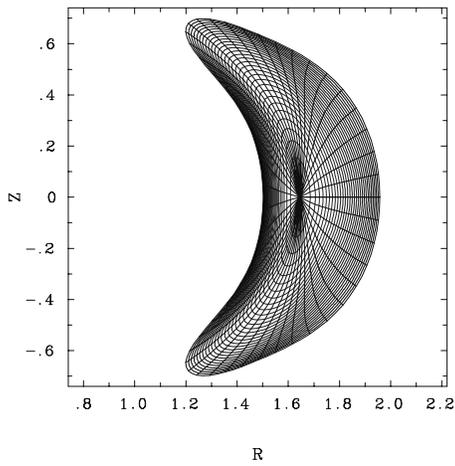
CONTOURS OF  $\sqrt{\phi}$



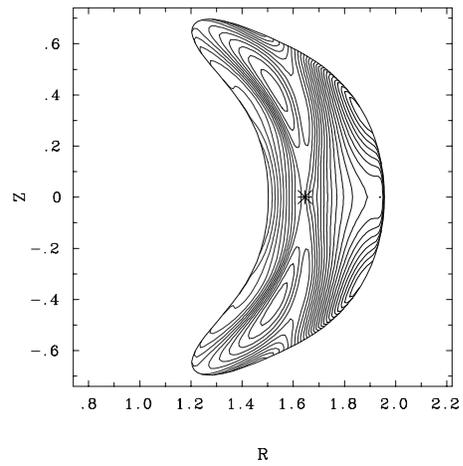
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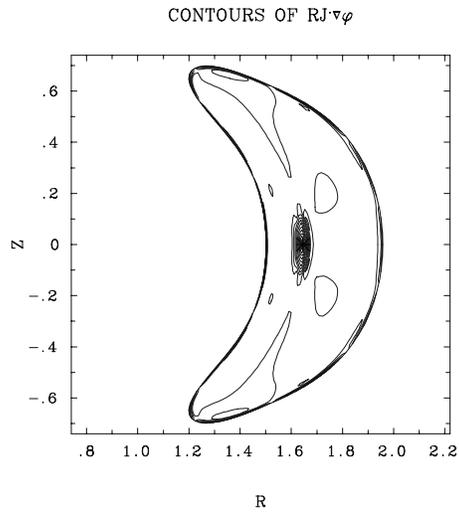
$\phi$  and  $\vartheta$  CONTOURS



JACOBIAN CONTOURS

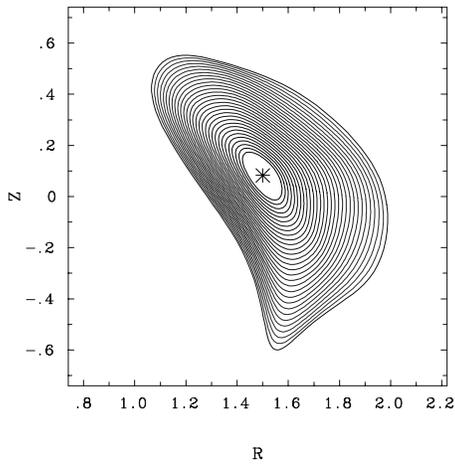


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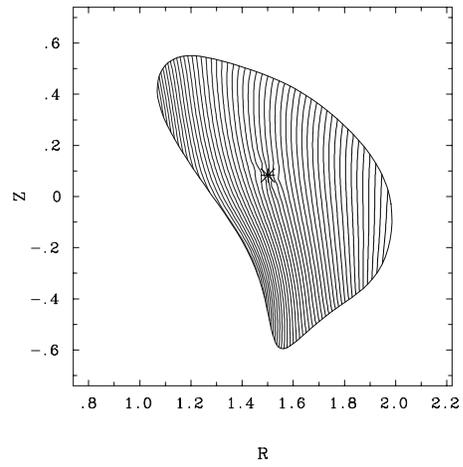


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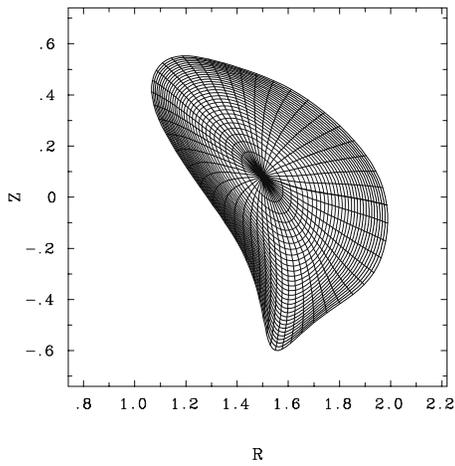
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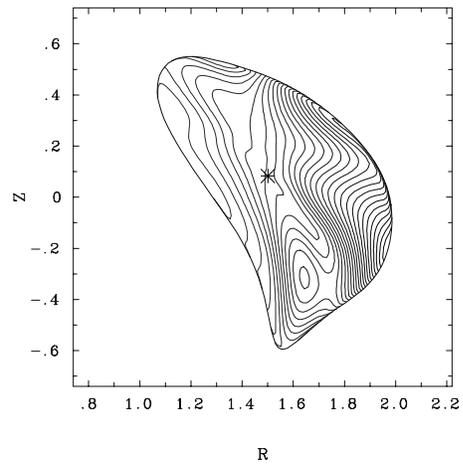
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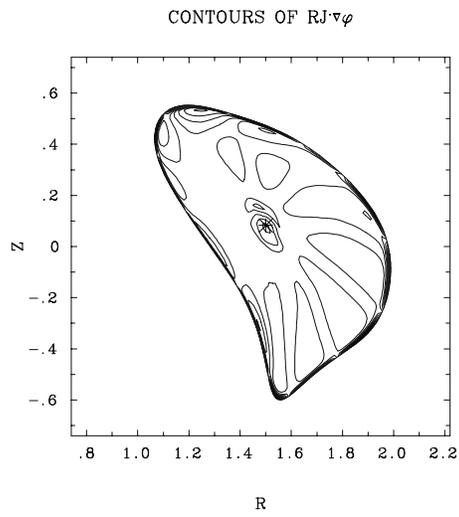
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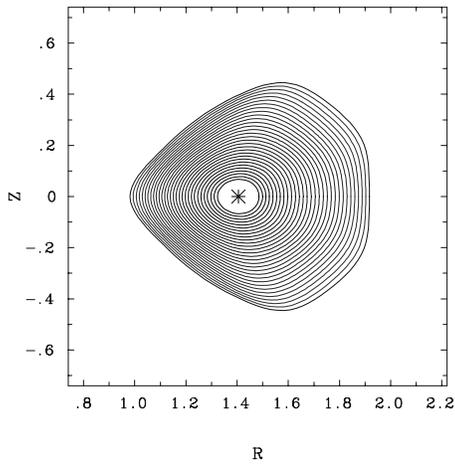
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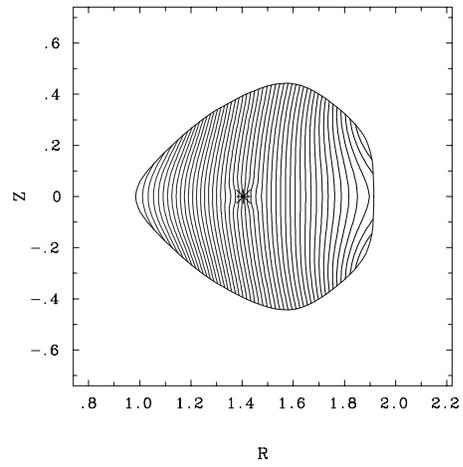
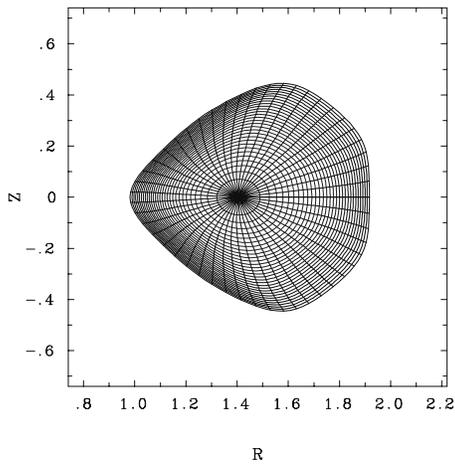
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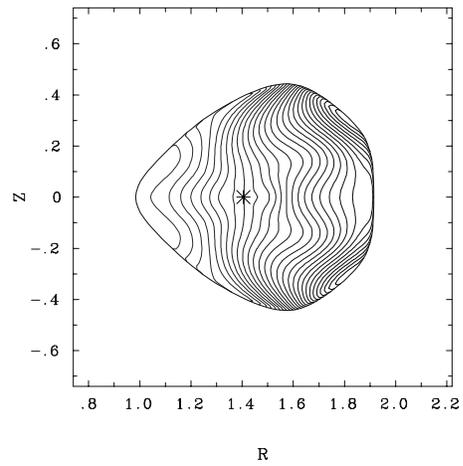
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CONTOURS OF  $\sqrt{\phi}$ 

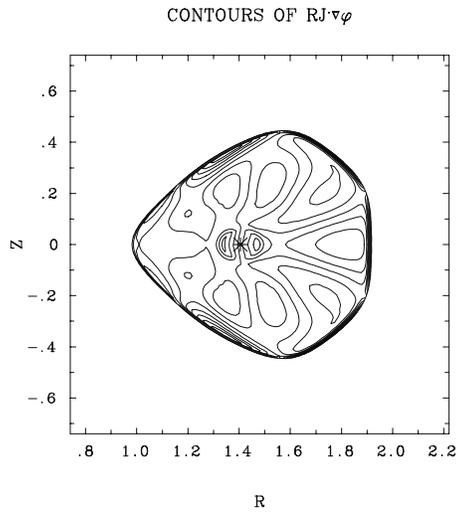
MOD-B CONTOURS

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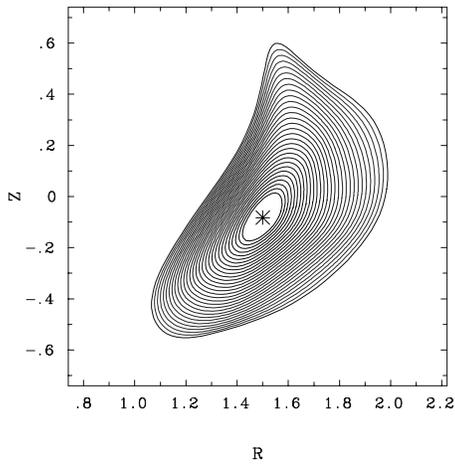
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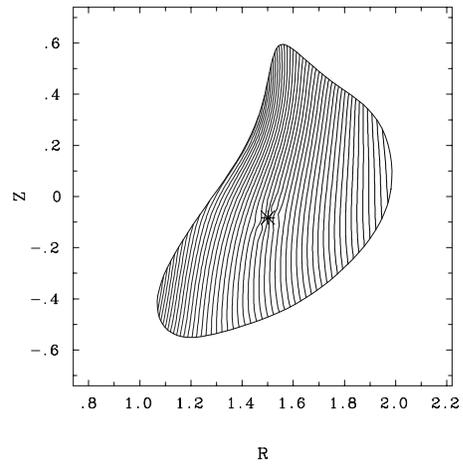
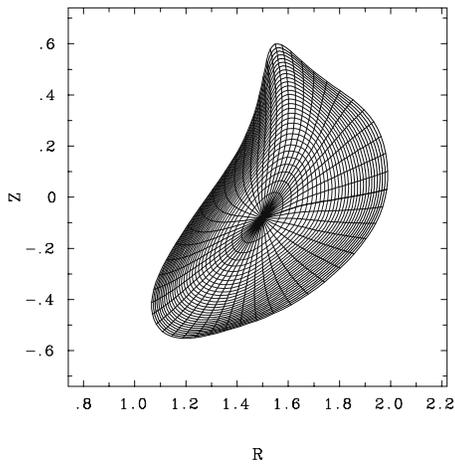
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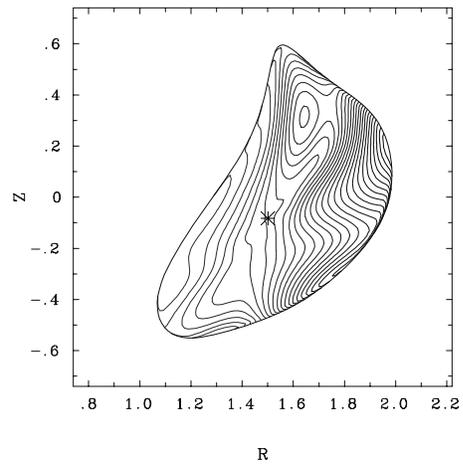
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CONTOURS OF  $\sqrt{\phi}$ 

MOD-B CONTOURS

 $\phi$  and  $\vartheta$  CONTOURS

JACOBIAN CONTOURS



$$N_f \varphi = 270^\circ$$

