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Dr. R.K. Varma  
Physical Research Laboratory  
Navrangpura, AHMEDABAD-9  
INDIA

VIA AIR MAIL





Jan 13, 1972

Dear Ram,

Thank you for your letter of Dec. 15: I had begun to wonder if you were drafted into the army with all the bad news ~~and~~ about the war and no correspondence from you. I really do not know why the U.S. govt. aligned itself with Pakistan in the dispute. Partly, it may be to ~~date~~ maintain a particular balance in US - Russia - China positions. We seem to be very preoccupied with developing a position or relationship of some kind with China. I think the public sentiment in the U.S. is <sup>largely</sup> pro - India because of a longer and earlier friendship with India and because of the killing of the Bengalis. I must say, there seems to be a dreadful

amount of civilian murdering and torturing etc. committed by both sides of the conflict.

Personally, I feel the liberation and formation of Bangladesh was a great step in the direction of justice and freedom for those people. It seems that the defeat may even help the people of western Pakistan by giving them a new, more responsible president.

I really do not ~~no why~~ understand why the U.S. should take ~~sides~~ either side in this ~~rather~~ asian, (internal) affair.

Recently, the public concern has been more on our prisoners of war in North Vietnam. We are alarmed at <sup>the</sup> prospects of not being able to negotiate their release.

~~No, problem~~

There was no problem with carrying out your directions about the money. I have closed your savings account and your checking account.

The two sent just covered your checking account balance. I put the \$500 in ~~an~~ my account for you to send for when you need it. The ~~other~~ check was combined with your savings account to give a total of \$3,914.30. This is being sent to you in two drafts on a New York Bank by registered mail. One draft is in this envelope and the other I shall mail in a day or two. I hope this is according to wishes.

Give Sushama and Homant our regards  
and we often talk of you.

I am amazed at how complicated  
life is in India if it required 15 days  
to secure your possessions! I hope  
you were not robbed by the custom  
agents.

Best regards,  
W. E. Bell



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Dr. R.K. Varma  
Physical Research Laboratory  
Navrangpura, AHMEDABAD-9  
INDIA

VIA AIR MAIL

June 2, 1972

Dear Ram,

Assuming you have received the galley proofs I sent to you, I would like to inquire if you have any corrections to make on them. I shall plan to return the proofs in a ~~few~~ few weeks so as to take care of this <sup>and</sup> avoid delay in the articles' publication.

I am not sure what to say about the notation problem and would like to ask what you think we should plan to do. I have read through your results but have not had a chance to check them. I am curious as to how you made the reduction

$$\Delta m [(1+T) \tilde{\eta} + T \tilde{\tau}_i + \tilde{\tau}_e] = \frac{v_0}{r k_{ii}^2 c_s^2} \left[ \frac{v_0}{r} \Delta m \eta + \frac{v_0 e}{r} \Delta m \xi \right]$$

This looks like a convenient form for  $\partial v_0 / \partial t$ ,

but I am surprised to see a root at  $v_0=0$  occur so generally. ~~With~~ The functions  $\eta(v_0)$ ,  $\xi(v_0), \dots$  must be finite for all  $v_0$  since  $\det(D(v_0)) \neq 0$  on the real axis. I have had Robert Koch, who you probably remember, make a numerical solution of the simultaneous equations. We solve the four simultaneous equations for  $\eta, \xi, \tau_i, \tau_e$  for  $v_0/c_s$  in a range from say  $-5$  to  $+5$ . and for each point compute  $v_0/\rho t$ . You give a 6th order polynomial for the numerator and the general case is at least this high an order or perhaps higher. The numerical show that ~~the~~ most of the roots are always ~~less~~ in the complex plane. What I see is either one root or 3 roots depending, in some way, on the relative size of  $\epsilon = \frac{a_0 d n}{n dr}$  to  $\lambda_{mp}/L_c$ . Large  $\epsilon$  giving 3 roots, large  $\lambda_{mp}/L_c$  giving one root. For example,



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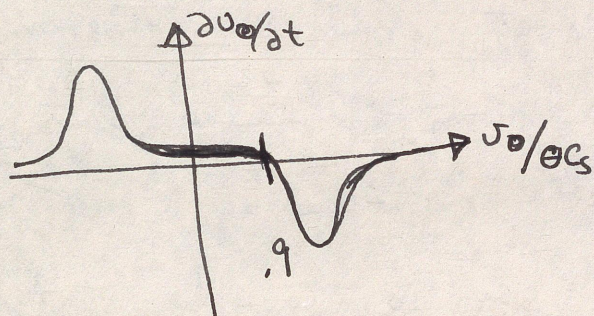


<sup>21</sup>  
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1)  $\epsilon = .5, T_i = T_e, \lambda_{mf0}/L_c = .1$  ( $\eta_i = \eta_e = 0$ ).

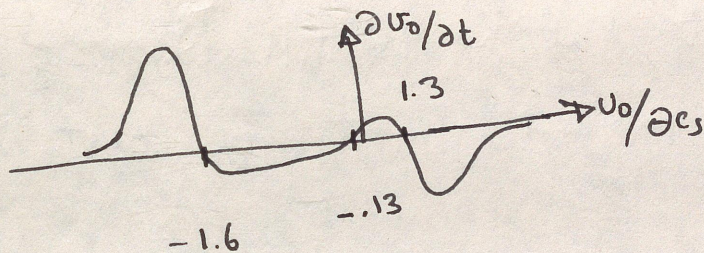
(one root)



The direction of rotation is to bring the ions to rest and is presumably due to large viscosity  $v_0 + v_{di} \approx 0$ .

2)  $\epsilon = 1, T_i = T_e, \lambda_{mf0}/L_c = .1$

(three roots)



It seems, One dilemma is that the ~~the~~ <sup>accurate</sup> results seem to require all the ~~terms in the eqn~~ quantities  $\tau, \eta, S$ , however, the equations seem ~~to be too~~ messy to manipulate and solve for the fluxes, at least in a ~~simple~~ understandable form. You have probably done more algebra on the problem than I have, and I would like suggestions on what we should do in this regard. Also what are the important questions to ask with the numerical code?

Neoclassical transport theory is done as an expansion in  $\epsilon$ . We might solve ~~out~~ our equations in such an expansion but I don't know what order we should ~~assume~~ assume for the other terms.

I really need to spend some time on the problem to correspond more effectively, but I seem to be still stuck on drift-waves.

Every one is fine here. Tokamak is going to be tried shortly I think. No replacement for Bertie yet, but he is still working with us. Give Sushma and Hamat my best regards.

Sincerely

Wendell



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Center for Plasma Physics  
and Thermonuclear Research

December 31, 1972

Dear Ram,

Libby and I send our warmest congratulations to Sushama and you on the birth of your new baby boy. I know he will bring great joy to you and he is very lucky to have such fine parents. We have been very busy over the holidays with visiting relatives and fixing up around the house. I have done some of the Christmas cooking this year (a small fraction of course). I helped with stuffing and roasting the turkey for Christmas day. We had eleven people for dinner on Christmas.

Thanks for the calculations on the rotation and diffusion problem. I will xerox them and return them shortly. I have not been able to work on the problem recently, however. During the past half year or so I have been working with Bill



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on setting up an exchange program between the Max-Planck Institut at Garching and Austin. We have about finished the arrangements, and it looks as though I will spend April-August inclusive at Garching and Henry Tasso will spend the same period here. This may be followed by other exchanges, which I think will be mutually advantageous.

We appreciate your interest in visiting Austin again and would certainly enjoy seeing here in the near future. I shall think ~~of~~ about ways of getting you visiting money; right now, however, I am in a poor position to do anything about it due to my impending trip and the fact that I shall need to help host the second German visitor next year who I think may be Barry Green. Nevertheless, I shall see what I can



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I find out about monies for a visit. I appreciate your reiterating ~~your~~ <sup>the</sup> invitation to visit Ahmedabad which we would like to do very much; however, I do not see how I can consider it for several years yet.

You asked about Monterey, by far the biggest interest was in the recent outstanding success of the Princeton ATC experiment which showed the successful use of compressional heating in a tokamak. The Phys. Rev. Letter in late November issue contains the relevant information showing a factor of 3 increase in temperature roughly as predicted by theory. I believe the best data was  $n_e = 2 \times 10^{19}$ ,  $T_e = 2.5$  keV and  $T_i = 600$  eV.) Theoretically, I didn't see much exciting except possibly an enhanced scattering rate theory of Callen and Baldwin - also a Phys. Rev. Letter some time during the summer.



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*Center for Plasma Physics  
and Thermonuclear Research*

May 9, 1972

Dr. R. K. Varma  
Physical Research Laboratory  
Navrangpura  
Ahmedabad-9, INDIA

Dear Ram:

I have just received the galley proofs of our article on "Nonadiabatic Escape of Charged Particles," and would you please check the copy I am enclosing for any changes you wish to make. I made some changes in the manuscript to accommodate Dr. Frenkiel's requests as you can see from the correspondence.

I plan to write you soon with work on the rotation problem. We have finished Tom Gladd's thesis work and my class work is finished this week. Give Sushama and Hamant my best wishes.

Sincerely yours,

*Wendell*

Wendell Horton

WH:jwh

enclosures

February 1, 1972

Dr. Francois N. Frenkiel  
Editor, The Physics of Fluids  
Computation and Mathematics  
Department  
Naval Ship Research and Development  
Center  
Bethesda, Maryland 20034

Dear Dr. Frenkiel:

I am returning the corrected manuscript "Schrodinger-Like Equations for the Non-Adiabotic Escape of Charge Particles" by Dr. R. K. Varma and myself. I have made the changes you detailed in your letter of December 23, 1971. Enclosed is the manuscript and one copy.

Thank you.

Sincerely yours,

Wendell Horton  
Associate Professor

WH/pwm  
Enc.

# THE PHYSICS OF FLUIDS

PUBLISHED BY THE AMERICAN INSTITUTE OF PHYSICS

François N. Frenkiel  
Editor

December 23, 1971

Office of the Editor  
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Bethesda, Maryland 20034

Professor Wendell Horton, Jr.  
Center for Plasma Physics and  
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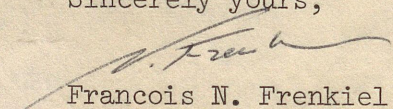
Dear Professor Horton:

I should like to let you know that the paper "Schrodinger-Like Equations for the Non-Adiabatic Behavior from Quantum Mechanics" by R. K. Varma and you has been accepted for publication in The Physics of Fluids subject to the following changes:

1. I would like to suggest that you change the title of the paper. Perhaps "Schrödinger-Like Equations for the Non-Adiabatic Escape of Charged Particles" would be satisfactory.
2. Please replace the "e" symbolism by the "exp" symbolism. This may be accomplished by retyping the equations and stripping them in at the proper place.
3. Please check symbols in Eq. (36).
4. The symbol  $\psi$  cannot be easily used by our printer; please replace it.
5. On page 14, the sentence beginning on line 5 is awkward; please reword it.
6. Please give complete title of journal in Ref. 2.
7. In Refs. 3 and 4 if you are not citing the entire book, please give the page or chapter to be cited.

I am returning the manuscript and copy so that you can make the necessary revisions.

Sincerely yours,

  
François N. Frenkiel

FNF:mjs

PF 7091

Enclosure