1997 CEDAR Workshop

Boulder, Colorado
June 8-13, 1997

Panel Discussion of Gravity Waves

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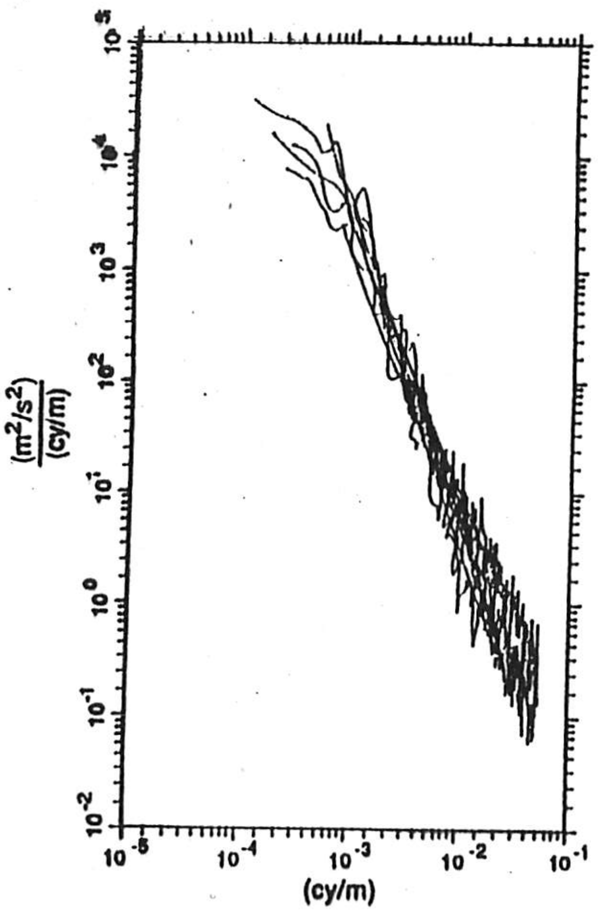
UNIVERSAL SPECTRUM AND SATURATION

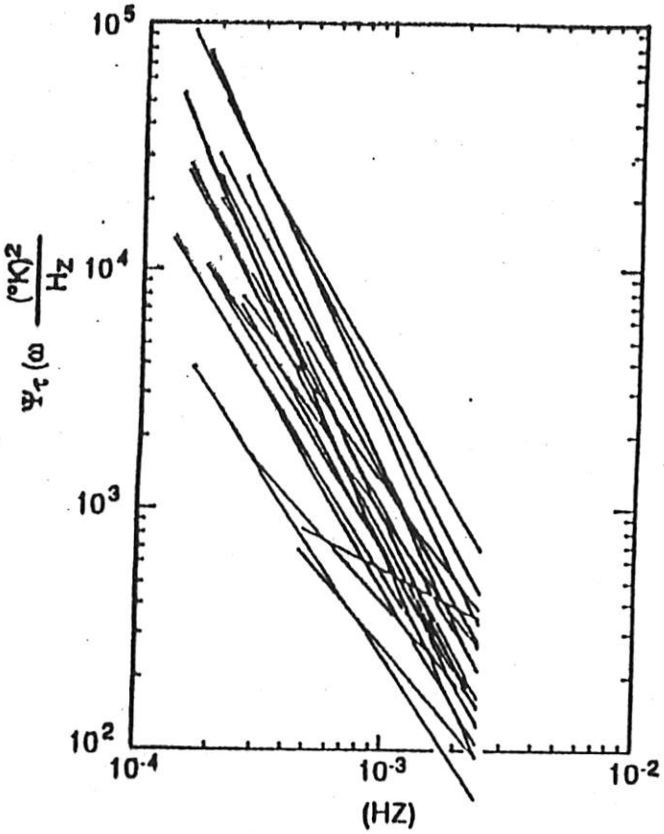


$$\Psi_{v_x}(k_z) = \frac{(\text{CONST.})\, N^2}{k_z^3}$$

Derived by dimensional analysis

Dewan and Good (1986): Linear Instability
Hines (1996): Doppler Spread Theory

NON-UNIVERSAL SPECTRUM AND CASCADE



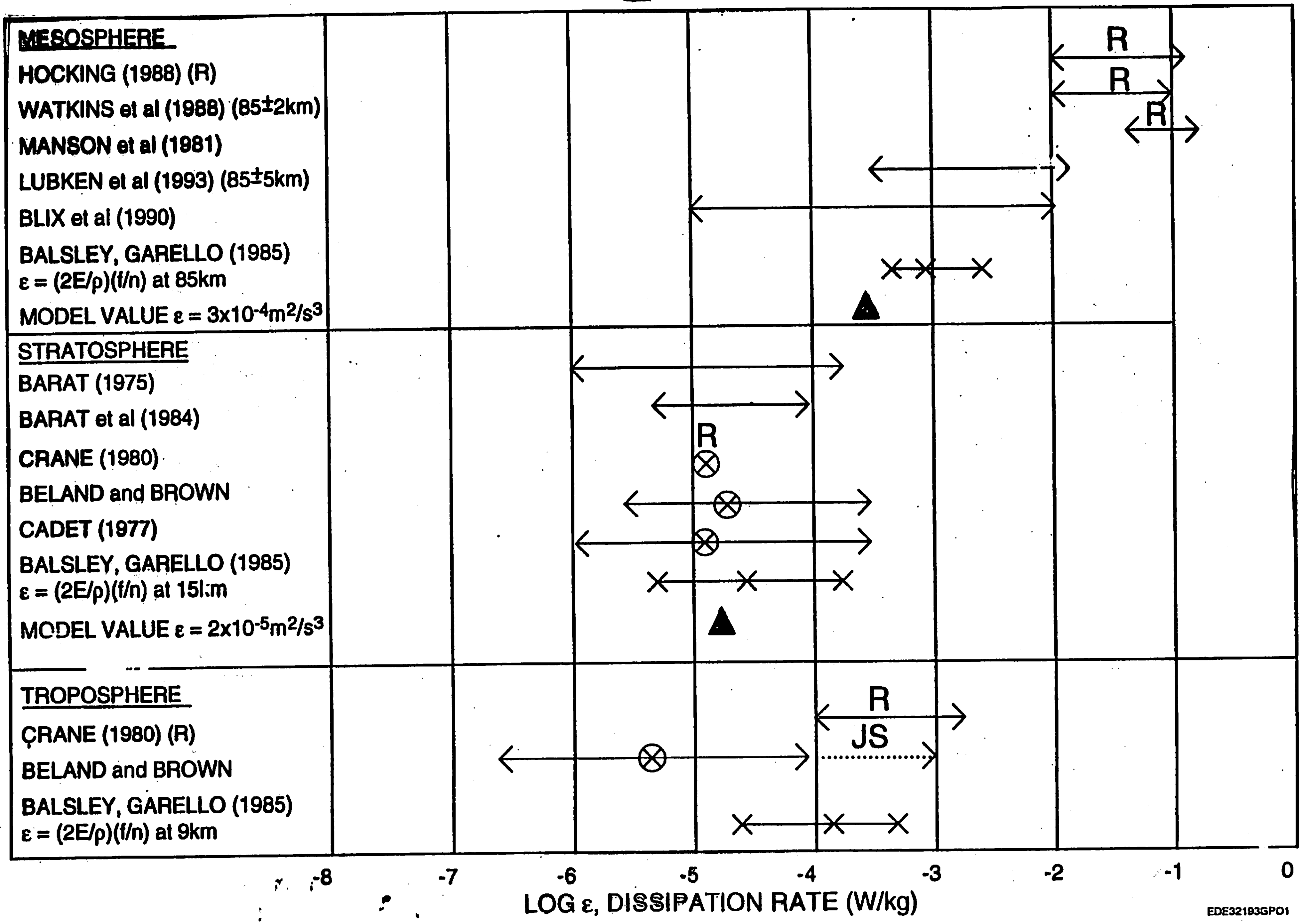
Derived by dimensional analysis

$$\psi_T(\omega) = \begin{cases} (\text{CONST.})\, \bar{\varepsilon}\, \omega^{-2} \\ (\text{CONST.})\, (\bar{\varepsilon} q)^{2/3}\, \omega^{-5/3} \end{cases} \quad (1)$$

$$\psi_{v_x}(k_x) = (\text{CONST.})\, \bar{\varepsilon}^{2/3}\, k_x^{-5/3} \quad (2)$$

(1) E. Dewan (1991)
(2) E. Dewan (1979)

ε


MESOSPHERE
HOCKING (1988) (R)
WATKINS et al (1988) (85±2km)
MANSON et al (1981)
LUBKEN et al (1993) (85±5km)
BLIX et al (1990)
BALSLEY, GARELLO (1985)
ε = (2E/ρ)(f/n) at 85km
MODEL VALUE ε = 3x10-4m2/s3
R
R
R
STRATOSPHERE
BARAT (1975)
BARAT et al (1984)
CRANE (1980)
BELAND and BROWN
CADET (1977)
BALSLEY, GARELLO (1985)
ε = (2E/ρ)(f/n) at 15km
MODEL VALUE ε = 2x10-5m2/s3
R
TROPOSPHERE
CRANE (1980) (R)
BELAND and BROWN
BALSLEY, GARELLO (1985)
ε = (2E/ρ)(f/n) at 9km
R
JS
-8
-7
-6
-5
-4
-3
-2
-1
0
LOG ε, DISSIPATION RATE (W/kg)
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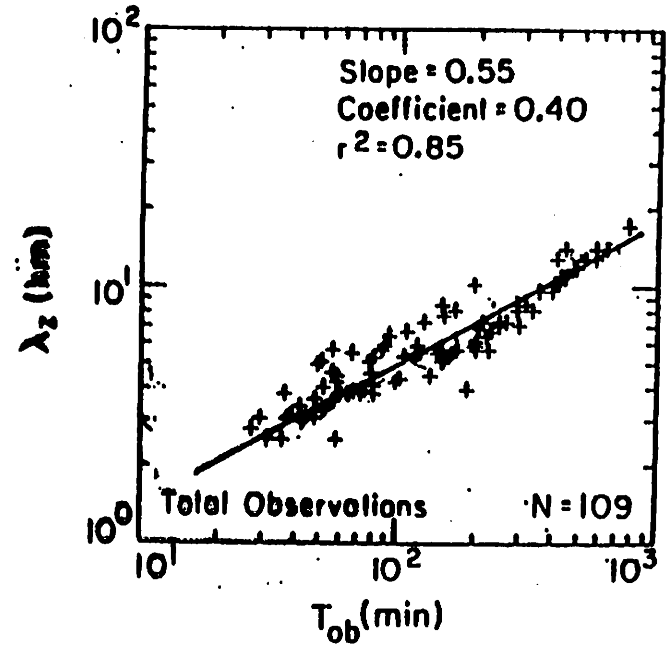
SATURATED CASCADE AND THE WAVE PERIOD – WAVELENGTH RELATIONS

Saturation	$v_x^2(k_z)\,k_z^2 = a_1 N^2$
Cascade	$v^2(\omega)\,\omega = a_2\,\varepsilon$

$$\lambda_x = \left[\bar{\varepsilon}\,\frac{a_2}{a_1}\right]\tau^{3/2}$$

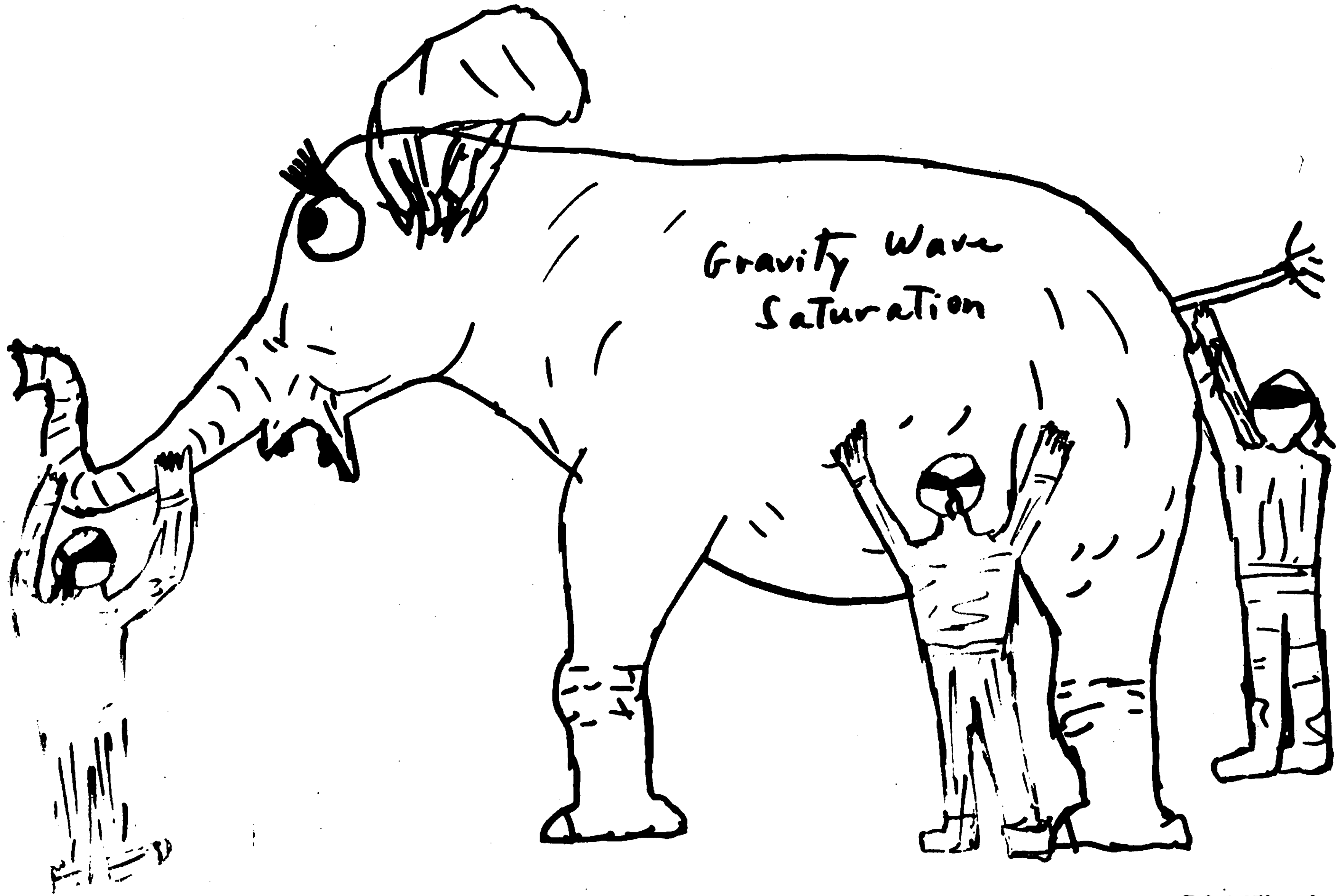
$$\lambda_z = \tau_B\left[\bar{\varepsilon}\,\frac{a_2}{a_1}\right]\tau^{1/2}$$



C. Gardner and D. Voelz (1987)

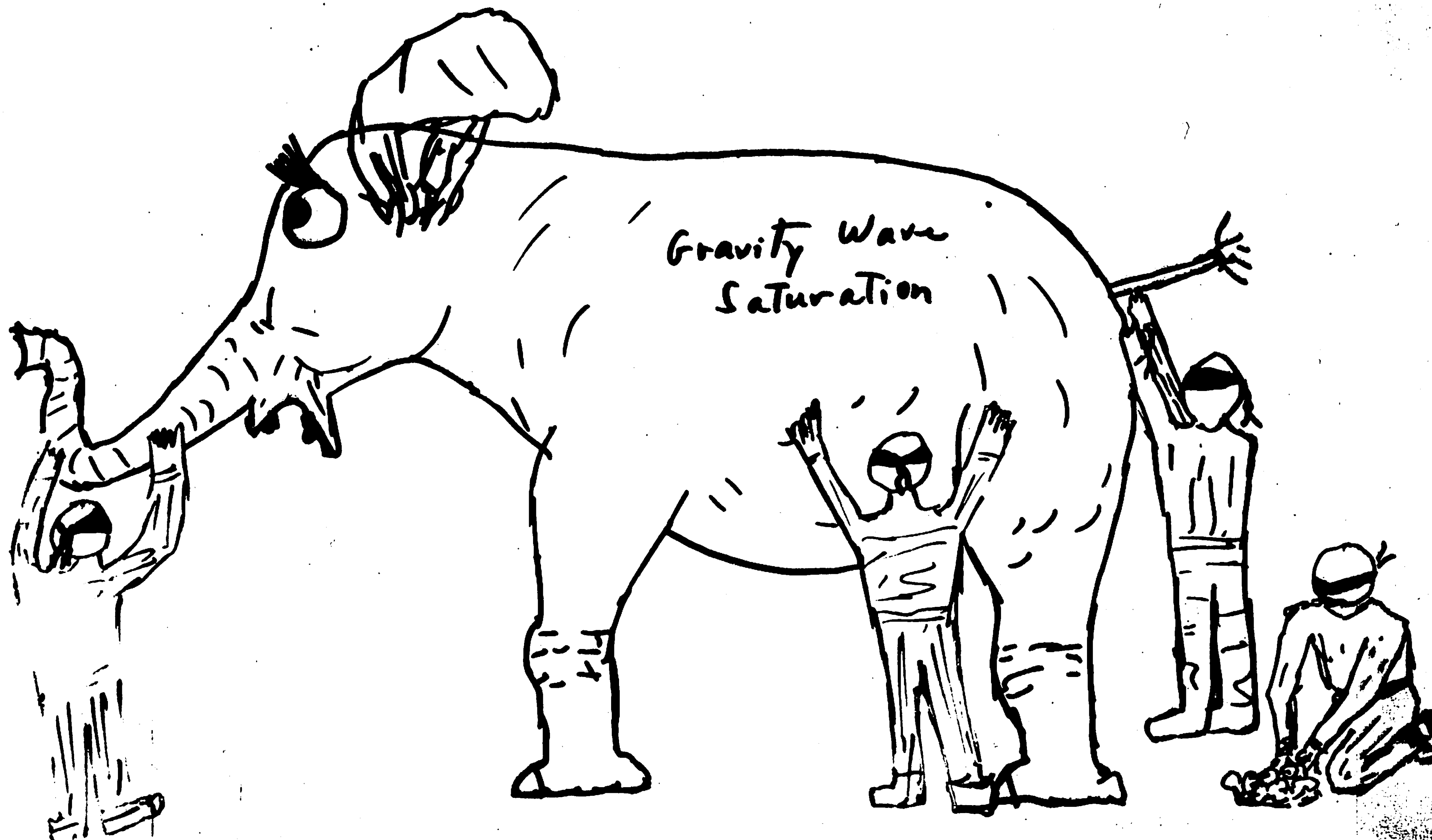
	k_x	k_z	ω
Δv_x	$\psi_{v_x}^{(e)}(k_x)=\dfrac{\alpha(\bar{\varepsilon})^{2/3}\left(\frac{a_2}{a_1}\right)^{2/3}}{3}k_x^{-5/3}\cdot(2\pi)$	$\psi_{v_x}^{(e)}(k_z)=\alpha N^2 k_z^{-3}\cdot(2\pi)$	$\psi_{v_x}^{(e)}(\omega)=\dfrac{\alpha(\bar{\varepsilon})}{2}\left(\frac{a_2}{a_1}\right)\omega^{-2}\cdot(2\pi)$
Δv_z	$\psi_{v_z}^{(e)}(k_x)=\dfrac{\alpha(\bar{\varepsilon})^{4/3}}{(3)N^2}\cdot\left(\frac{a_2}{a_1}\right)^{4/3}k_x^{-1/3}\cdot(2\pi)$	$\psi_{v_z}^{(e)}(k_z)=\dfrac{\alpha(\bar{\varepsilon})^2\left(\frac{a_2}{a_1}\right)^2}{N^4}k_z^{1}\cdot(2\pi)^*$	$\psi_{v_z}^{(e)}(\omega)=\dfrac{\alpha(\bar{\varepsilon})}{2N^2}\left(\frac{a_2}{a_1}\right)\cdot(2\pi)$
ΔT	$\psi_{T}^{(e)}(k_x)=\dfrac{\alpha}{N^2}\cdot\dfrac{(\bar{\varepsilon})^{2/3}}{3}\left(\frac{a_2}{a_1}\right)^{2/3}\left[\frac{T}{H}\frac{(\gamma-1)}{\gamma}\right]^2 k_x^{-5/3}\cdot(2\pi)$	$\psi_{T}^{(e)}(k_z)=\alpha\left[\frac{T}{H}\frac{(\gamma-1)}{\gamma}\right]^2 k_z^{-3}\cdot(2\pi)^*$	$\psi_{T}^{(e)}(\omega)=\dfrac{\alpha(\bar{\varepsilon})}{2N^2}\left(\frac{a_2}{a_1}\right)\left[\frac{T}{H}\frac{(\gamma-1)}{\gamma}\right]^2\omega^{-2}\cdot(2\pi)$
$\Delta\rho$	$\psi_{\frac{\Delta\rho}{\rho}}^{(e)}(k_x)=\alpha\dfrac{(\bar{\varepsilon})^{2/3}}{(3)N^2}\left(\frac{a_2}{a_1}\right)^{2/3}\left[\left(\frac{\gamma-1}{\gamma}\right)\frac{1}{H}\right]^2 k_x^{-5/3}\cdot(2\pi)$	$\psi_{\frac{\Delta\rho}{\rho}}^{(e)}(k_z)=\alpha\left[\left(\frac{\gamma-1}{\gamma}\right)\frac{1}{H}\right]^2 k_z^{-3}\cdot(2\pi)^*$	$\psi_{\frac{\Delta\rho}{\rho}}^{(e)}(\omega)=\dfrac{\alpha(\bar{\varepsilon})}{2N^2}\left(\frac{a_2}{a_1}\right)\left[\left(\frac{\gamma-1}{\gamma}\right)\frac{1}{H}\right]^2\omega^{-2}\cdot(2\pi)$

Theorists in search of Truth

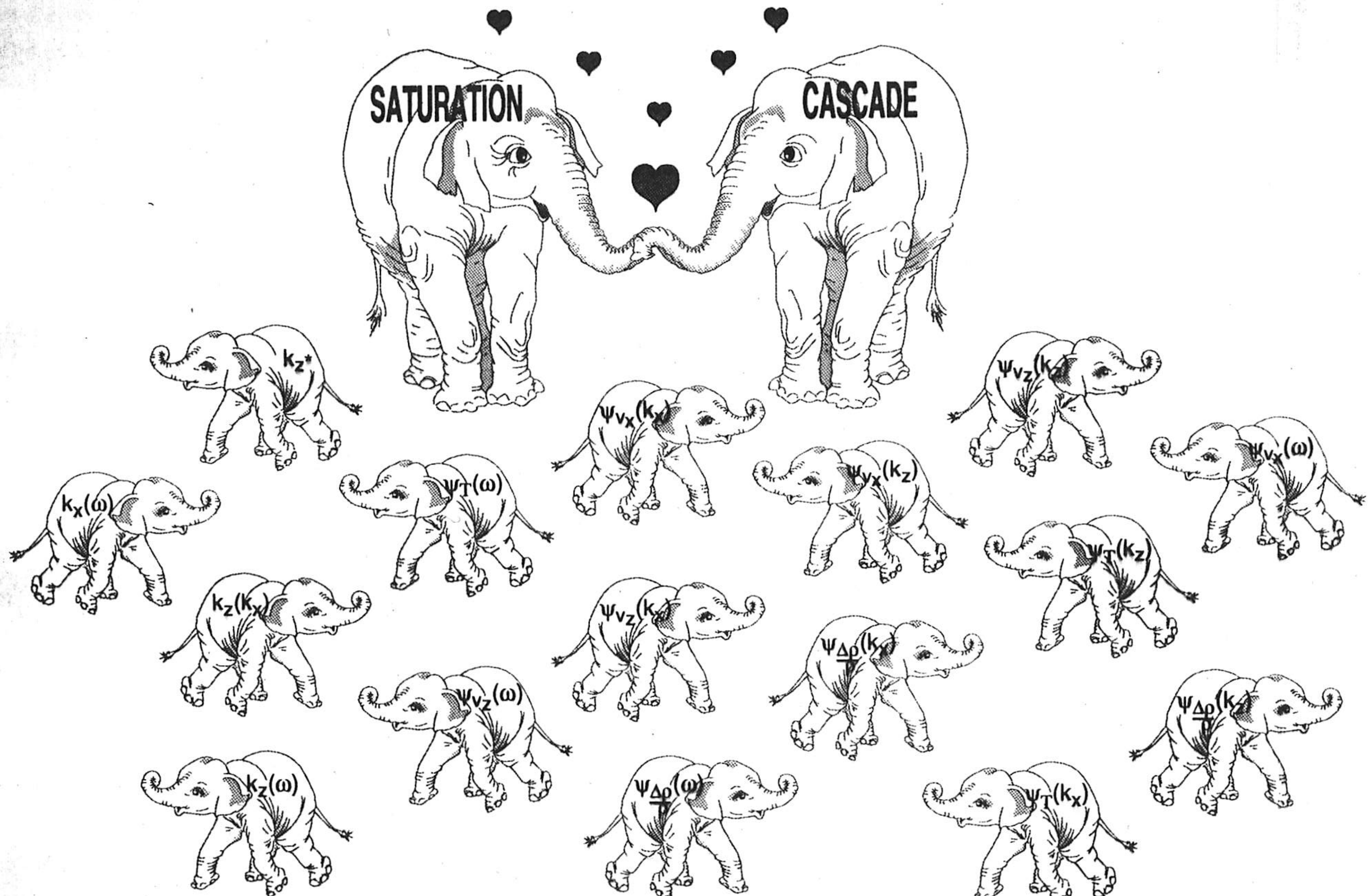


ARTIST : D. C. FRITTS

Theorists in search of Truth



ARTISTS: D. C. FRITTS
AND C.O. HINES



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