

G3 - программа курса для школьников

размерные и массовые
единицы в физике.

1. Комплексные зависимости физических величин: их закономерности. Узники по порядку величин: их место в физике. "Здравствуй съешь!"

~~Сколько единиц давление есть в физике?~~

2. Составление размерности. Структура формулы, выражениях физических зависимостей. Важнейшие масштабы и их величины.

Законы подсказки.

~~Если землю считать в физике единицей & звезды нет в физике, то что это?~~

3. Задачи без собственных масштабов: примеры (механика; гидродинамика)

Кто превратил вану - туннельную или кенгуру?

Кто испортил башню - сапера или гондоль?

4. Классические модели в атомной и ядерной физике.

Линия свободного падения;
атомская;
компьютерная модель ядра /.
одинаковая везде.

VI. EXTRINSIC INTERMITTENCY

In the absence of external noise, the lifetimes of separate stable running modes of the driven damped pendulum are infinite. In any real physical system, external noise is always present, and will eventually cause transitions between previously stable attractors. As the noise level increases the lifetime of the attractors will decrease. We study the influence of external noise on the driven, damped pendulum by adding a random torque $\delta g(t)$ to the right-hand side of the equation of motion in Eq. (1). Because the amplitude distribution of physical noise sources is usually Gaussian, we add at each integration time step a torque $\delta g(t)$ that is a random number drawn from a normal distribution with standard deviation σ . This noise torque may be regarded as the average of a physical noise source over a time interval equal to the time step $\Delta t = \pi/100$ (300 time steps per drive cycle).

The noise-induced hopping rate and power spectrum are determined both by the effect of noise on the attractors and by the geometry of the basins of attraction. The influence of external noise on the attractor for the running modes described previously is illustrated in Fig. 14, which shows pairs of noise-free and noise-broadened Poincaré sections of the attractor for three different drive amplitudes. In all cases noise broadens the attractor asymmet-

dark segments at the bottom for $\langle d\theta/dt \rangle = -\omega_d$. Hoping between these modes takes place when the broadened attractor intersects the boundary of the basin of attraction, along the thin filaments that connect the dark regions.

The influence of external noise on chaotic attractors is illustrated in Figs. 14(b) and 14(c), which show Poincaré sections of the chaotic running modes for $g = 1.48$ and 1.4954 , respectively, which were discussed above. As shown, external noise tends to spread the attractors along the directions in which the flow is expanding, producing an object which strongly resembles the unlocked intermittent attractor. The basins of attraction for $g = 1.48$ are shown in Fig. 3(b); the basin boundaries are highly folded with fractal dimension $d = 1.88$. The noise-free chaotic attractors for this drive amplitude shown in Fig. 14(e) approach the basin boundary more closely than the periodic attractors in Fig. 14(d), and hopping between attractors is more easily induced by external noise. In Fig. 14(f), for $g = 1.4954$, just below the crisis at g_c , the dimension of the basin boundary is close to 2, and the separation between the attractors and the basin boundaries is extremely small. In this case intermittency is induced by a very small noise level and produces the attractor shown in Fig. 14(c) for $\sigma = 0.01$. This noise-broadened attractor is practically identical to the intrinsically intermittent attractor shown in Fig. 9.

Far from the crisis, the attractors and the basin boundary are separated by a finite distance, and the dimension

Figure 14. Externally magnetically intermittent attractors created by adding Gaussian noise with standard deviation σ to Eq. (1) for $Q = 2$, $\omega = 0.3500$; (c) $\bar{g} = 1.4954$, $\sigma = 0.0100$; (d) $\bar{g} = 1.3000$; (e) $\bar{g} = 1.4800$; (f) $\bar{g} = 1.4954$. (a)–(c) are shown in (a)–(c); the corresponding noise-free attractors are shown in (d)–(f). (a) $\bar{g} = 1.3000$, $\sigma = 0.3500$; (b) $\bar{g} = 1.4800$, $\sigma = \frac{2}{3}$ are shown in (a)–(c); the corresponding noise-free attractors are shown in (d)–(f). The parts of the attractor in (a)–(c) that correspond to this motion are the dark regions at the bottom of the figure. The parts of the attractor in Fig. 14(a) that correspond to this motion are the dark regions at the bottom of the figure.

